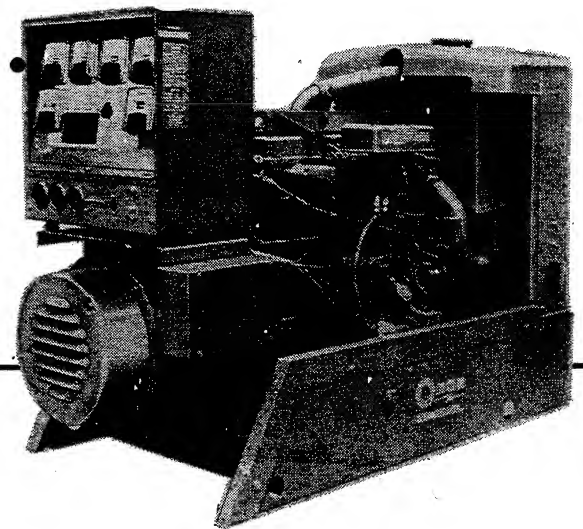




Operator's Manual

RDJC, RDJF

GenSets



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Safety Precautions

Before operating the generator set, read the Operator's Manual and become familiar with it and the equipment. **Safe and efficient operation can be achieved only if the equipment is properly operated and maintained.** Many accidents are caused by failure to follow fundamental rules and precautions.

The following symbols, found throughout this manual, alert you to potentially dangerous conditions to the operator, service personnel, or the equipment.

⚠ DANGER *This symbol warns of immediate hazards which will result in severe personal injury or death.*

⚠ WARNING *This symbol refers to a hazard or unsafe practice which can result in severe personal injury or death.*

⚠ CAUTION *This symbol refers to a hazard or unsafe practice which can result in personal injury or product or property damage.*

FUEL AND FUMES ARE FLAMMABLE. Fire and explosion can result from improper practices.

- DO NOT fill fuel tanks while engine is running, unless tanks are outside the engine compartment. Fuel contact with hot engine or exhaust is a potential fire hazard.
- DO NOT permit any flame, cigarette, pilot light, spark, or other ignition source near the generator set or fuel tank.
- Fuel lines must be adequately secured and free of leaks. Fuel connection at the engine should be made with an approved flexible line. Do not use copper piping on flexible lines as copper will become brittle if continuously vibrated or repeatedly bent.
- Be sure all fuel supplies have a positive shutoff valve.
- Do not smoke while servicing lead acid batteries. Lead acid batteries emit a highly explosive hydrogen gas that can be ignited by electrical arcing or by smoking.

EXHAUST GASES ARE DEADLY

- Provide an adequate exhaust system to properly expel discharged gases. Visually and audibly inspect the exhaust daily for leaks per the maintenance schedule. Ensure that exhaust manifolds are secured and not warped. Do not use exhaust gases to heat a compartment.
- Be sure the unit is well ventilated.

MOVING PARTS CAN CAUSE SEVERE PERSONAL INJURY OR DEATH

- Keep your hands, clothing, and jewelry away from moving parts.
- Before starting work on the generator set, disconnect starting batteries, negative (-) cable first. This will prevent accidental starting.
- Make sure that fasteners on the generator set are secure. Tighten supports and clamps, keep guards in position over fans, drive belts, etc.

- Do not wear loose clothing or jewelry in the vicinity of moving parts, or while working on electrical equipment. Loose clothing and jewelry can become caught in moving parts. Jewelry can short out electrical contacts and cause shock or burning.
- If adjustment must be made while the unit is running, use extreme caution around hot manifolds, moving parts, etc.

ELECTRICAL SHOCK CAN CAUSE SEVERE PERSONAL INJURY OR DEATH

- Remove electric power before removing protective shields or touching electrical equipment. Use rubber insulative mats placed on dry wood platforms over floors that are metal or concrete when around electrical equipment. Do not wear damp clothing (particularly wet shoes) or allow skin surface to be damp when handling electrical equipment.
- Use extreme caution when working on electrical components. High voltages can cause injury or death. DO NOT tamper with interlocks.
- Follow all applicable state and local electrical codes. Have all electrical installations performed by a qualified licensed electrician. Tag open switches to avoid accidental closure.
- DO NOT CONNECT GENERATOR SET DIRECTLY TO ANY BUILDING ELECTRICAL SYSTEM. Hazardous voltages can flow from the generator set into the utility line. This creates a potential for electrocution or property damage. Connect only through an approved isolation switch or an approved paralleling device.

GENERAL SAFETY PRECAUTIONS

- Coolants under pressure have a higher boiling point than water. DO NOT open a radiator or heat exchanger pressure cap while the engine is running. Allow the generator set to cool and bleed the system pressure first.
- Benzene and lead, found in some gasoline, have been identified by some state and federal agencies as causing cancer or reproductive toxicity. When checking, draining or adding gasoline, take care not to ingest, breathe the fumes, or contact gasoline.
- Used engine oils have been identified by some state or federal agencies as causing cancer or reproductive toxicity. When checking or changing engine oil, take care not to ingest, breathe the fumes, or contact used oil.
- Provide appropriate fire extinguishers and install them in convenient locations. Consult the local fire department for the correct type of extinguisher to use. Do not use foam on electrical fires. Use extinguishers rated ABC by NFPA.
- Make sure that rags are not left on or near the engine.
- Remove all unnecessary grease and oil from the unit. Accumulated grease and oil can cause overheating and engine damage which present a potential fire hazard.
- Keep the generator set and the surrounding area clean and free from obstructions. Remove any debris from the set and keep the floor clean and dry.
- Do not work on this equipment when mentally or physically fatigued, or after consuming any alcohol or drug that makes the operation of equipment unsafe.

Important Safety Precautions

Read and observe these safety precautions when using or working on electric generators, engines and related equipment. Also read and follow the literature provided with the equipment.

Proper operation and maintenance are critical to performance and safety. Electricity, fuel, exhaust, moving parts and batteries present hazards that can cause severe personal injury or death.

FUEL, ENGINE OIL, AND FUMES ARE FLAMMABLE AND TOXIC

Fire, explosion, and personal injury can result from improper practices.

- Used engine oil, and benzene and lead, found in some gasoline, have been identified by government agencies as causing cancer or reproductive toxicity. When checking, draining or adding fuel or oil, do not ingest, breathe the fumes, or contact gasoline or used oil.
- Do not fill tanks with engine running. Do not smoke around the area. Wipe up oil or fuel spills. Do not leave rags in engine compartment or on equipment. Keep this and surrounding area clean.
- Inspect fuel system before each operation and periodically while running.
- Equip fuel supply with a positive fuel shutoff.
- Do not store or transport equipment with fuel in tank.
- Keep an ABC-rated fire extinguisher available near equipment and adjacent areas for use on all types of fires except alcohol.
- Unless provided with equipment or noted otherwise in installation manual, fuel lines must be copper or steel, secured, free of leaks and separated or shielded from electrical wiring.
- Use approved, non-conductive flexible fuel hose for fuel connections. Do not use copper tubing as a flexible connection. It will work-harden and break.

EXHAUST GAS IS DEADLY

- Engine exhaust contains carbon monoxide (CO), an odorless, invisible, poisonous gas. Learn the symptoms of CO poisoning.
- Never sleep in a vessel, vehicle, or room with a genset or engine running unless the area is equipped with an operating CO detector with an audible alarm.
- Each time the engine or genset is started, or at least every day, thoroughly inspect the exhaust system. Shut down the unit and repair leaks immediately.

- Warning: Engine exhaust is known to the State of California to cause cancer, birth defects and other reproductive harm.

Make sure exhaust is properly ventilated.

- Vessel bilge must have an operating power exhaust.
- Vehicle exhaust system must extend beyond vehicle perimeter and not near windows, doors or vents.
- Do not use engine or genset cooling air to heat an area.
- Do not operate engine/genset in enclosed area without ample fresh air ventilation.
- Expel exhaust away from enclosed, sheltered, or occupied areas.
- Make sure exhaust system components are securely fastened and not warped.

MOVING PARTS CAN CAUSE SEVERE PERSONAL INJURY OR DEATH

- Do not remove any guards or covers with the equipment running.
- Keep hands, clothing, hair, and jewelry away from moving parts.
- Before performing any maintenance, disconnect battery (negative [-] cable first) to prevent accidental starting.
- Make sure fasteners and joints are secure. Tighten supports and clamps, keep guards in position over fans, drive belts, etc.
- If adjustments must be made while equipment is running, use extreme caution around hot manifolds and moving parts, etc. Wear safety glasses and protective clothing.

BATTERY GAS IS EXPLOSIVE

- Wear safety glasses and do not smoke while servicing batteries.
- Always disconnect battery negative (-) lead first and reconnect it last. Make sure you connect battery correctly. A direct short across battery terminals can cause an explosion. Do not smoke while servicing batteries. Hydrogen gas given off during charging is explosive.
- Do not disconnect or connect battery cables if fuel vapors are present. Ventilate the area thoroughly.

DO NOT OPERATE IN FLAMMABLE AND EXPLOSIVE ENVIRONMENTS

Flammable vapor can be ignited by equipment operation or cause a diesel engine to overspeed and become difficult to stop, resulting in possible fire, explosion, severe personal injury and death. **Do not operate diesel equipment where a flammable vapor environment can be created by fuel spill, leak, etc., unless equipped with an automatic safety device to block the air intake and stop the engine.**

HOT COOLANT CAN CAUSE SEVERE PERSONAL INJURY

- Hot coolant is under pressure. Do not loosen the coolant pressure cap while the engine is hot. Let the engine cool before opening the pressure cap.

ELECTRICAL SHOCK CAN CAUSE SEVERE PERSONAL INJURY OR DEATH

- Do not service control panel or engine with unit running. High voltages are present. Work that must be done while unit is running should be done only by qualified service personnel.
- Do not connect the generator set to the public utility or to any other electrical power system. Electrocutation can occur at a remote site where line or equipment repairs are being made. An approved transfer switch must be used if more than one power source is connected.
- Disconnect starting battery (negative [–] cable first) before removing protective shields or touching electrical equipment. Use insulative mats placed on dry wood platforms. Do not wear jewelry, damp clothing or allow skin surface to be damp when handling electrical equipment.
- Use insulated tools. Do not tamper with interlocks.
- Follow all applicable state and local electrical codes. Have all electrical installations performed by a qualified licensed electrician. Tag open switches to avoid accidental closure.
- With transfer switches, keep cabinet closed and locked. Only authorized personnel should have cabinet or operational keys. Due to serious shock hazard from high voltages within cabinet, all service and adjustments must be performed by an electrician or authorized service representative.

If the cabinet must be opened for any reason:

1. Move genset operation switch or Stop/Auto/Handcrank switch (whichever applies) to Stop.
2. Disconnect genset batteries (negative [–] lead first).
3. Remove AC power to automatic transfer switch. If instructions require otherwise, use extreme caution due to shock hazard.

MEDIUM VOLTAGE GENERATOR SETS (601V TO 15kV)

- Medium voltage acts differently than low voltage. Special equipment and training are required to work on or around medium voltage equipment. Operation and maintenance must be done only by persons trained and qualified to work on such devices. Improper use or procedures will result in severe personal injury or death.
- Do not work on energized equipment. Unauthorized personnel must not be permitted near energized equipment. Induced voltage remains even after equipment is disconnected from the power source. Plan maintenance with authorized personnel so equipment can be de-energized and safely grounded.

GENERAL SAFETY PRECAUTIONS

- Do not work on equipment when mentally or physically fatigued or after consuming alcohol or drugs.
- Carefully follow all applicable local, state and federal codes.
- Never step on equipment (as when entering or leaving the engine compartment). It can stress and break unit components, possibly resulting in dangerous operating conditions from leaking fuel, leaking exhaust fumes, etc.
- Keep equipment and area clean. Oil, grease, dirt, or stowed gear can cause fire or damage equipment by restricting airflow.
- Equipment owners and operators are solely responsible for operating equipment safely. Contact your authorized Onan/Cummins dealer or distributor for more information.

KEEP THIS DOCUMENT NEAR EQUIPMENT FOR EASY REFERENCE.

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Section 1. General Information

This manual contains information on operating, maintaining, servicing, and adjusting the Onan RDJC generator set. Study and follow these instructions carefully. A well-planned service and maintenance program will help provide longer unit life and better performance.

In this manual, the engine end of the generator set is defined as the front. The "left" and "right" sides are defined when facing the engine (front) end.

HOW TO OBTAIN SERVICE

When the generator set requires servicing, contact your nearest dealer or distributor. Factory-trained Parts and Service representatives are ready to handle all your service needs.

If unable to locate a dealer or distributor, consult the Yellow Pages. Typically, our distributors are listed under:

GENERATORS-ELECTRIC, or
ENGINES-GASOLINE OR DIESEL

For the name of your local Cummins/Onan or Onan-only distributor in the United States or Canada, call 1-800-888-ONAN (this automated service uses touch-tone phones only). By entering your area code and the

first three digits of your local telephone number, you will receive the name and telephone number of the distributor nearest you.

For the name of your local Cummins-only distributor, or if you need more assistance, please call Onan Corporation, 1-612-574-5000, 7:30 AM to 4:00 PM, Central Standard Time, Monday through Friday.

When contacting your distributor, always supply the complete Model Number and Serial Number as shown on the generator set nameplate.

Onan gensets are given a complete running test under a variety of load conditions, and are thoroughly checked before leaving the factory. Examine this unit closely when it arrives, for possible shipping damage. Tighten loose parts, replace missing parts and repair all visible damage before starting the unit.

MODEL IDENTIFICATION

When this manual refers to a specific generator set, identify it by referring to the MODEL and SPEC NO. shown on the unit nameplate. Electrical specs are listed on the lower portion of the nameplate.

⚠WARNING

INCORRECT SERVICE OR REPLACEMENT OF PARTS CAN RESULT IN SEVERE PERSONAL INJURY, DEATH, AND/OR EQUIPMENT DAMAGE. SERVICE PERSONNEL MUST BE QUALIFIED TO PERFORM ELECTRICAL AND/OR MECHANICAL SERVICE.

⚠WARNING

EXHAUST GAS IS DEADLY!

Exhaust gases contain carbon monoxide, an odorless and colorless gas. Carbon monoxide is poisonous and can cause unconsciousness and death. Symptoms of carbon monoxide poisoning can include:

- Dizziness
- Nausea
- Headache
- Weakness and Sleepiness
- Throbbing in Temples
- Muscular Twitching
- Vomiting
- Inability to Think Coherently

IF YOU OR ANYONE ELSE EXPERIENCE ANY OF THESE SYMPTOMS, GET OUT INTO THE FRESH AIR IMMEDIATELY. If symptoms persist, seek medical attention. Shut down the unit and do not operate until it has been inspected and repaired.

Protection against carbon monoxide inhalation includes proper installation and regular, frequent visual and audible inspections of the complete exhaust system.

Section 2. Specifications

DIMENSIONS

Height	40.12 inches (1019 mm)
Width	27.00 inches (686 mm)
Length	56.62 inches (1438 mm)
Weight	940 lbs (426 kg)

ENGINE

Number of Cylinders	4
Displacement	120 in³ (1.97 l)
Cylinder Bore	3.25 in. (82.6 mm)
Piston Stroke	3.625 in. (92.1 mm)
RPM	50 Hz 1500 rpm
	60 Hz 1800 rpm
Compression Ratio	19.0:1
Recommended Fuel	#1 or #2 diesel
Starting System (automotive type)	Solenoid shift starter
Exhaust Connection (pipe tapped)	1.5 in. (38.1 mm)
Diesel Fuel Lift (max.)	6 feet (1.8 m)
Oil Filter	Full flow type
Lubrication System (Oil pump)	Full pressure
Fuel Consumption (full load)	1.6 gallons/h (6 liters/h) (60 hz sets at 1800 rpm)
	1.4 gallons/h (5 liters/h) (50 hz sets at 1500 rpm)

GENERATOR

Design	Revolving field, 4-pole, brushless exciter, solid state voltage regulator
Wire	4 (single-phase), 12 (three-phase)
Output Rating	1.0 power factor (single-phase)
	0.8 power factor (three-phase)
Cranking Current	225 amps at ambient temperature of 32° F (0° C)
Rating (AC output)	12.5 RDJC: 12.5 kw (60 hz)
	15.0 RDJC: 15 kw (60 hz)
	12.5 RDJC: 12.5 kw (50 hz)

REQUIREMENTS

Battery Voltage	.....	12 Volt, negative ground
Battery Size	..... 32° F (0° C)	560 amps (cold cranking)
	..... 0° F (-18° C)	800 amps (cold cranking)
Battery Charge Rate	.....	2 to 5 amps (adjustable)
Oil Capacity	.....	6.5 U.S. quarts (6.15 l)
Water Capacity (Radiator)	.....	13 U.S. quarts (12 l)
Cooling Water Flow	.....	24 g/m (91 l/m)
Engine Fan Size/RPM	.....	14 in./2900 rpm, belt-driven, pusher, CCW rotation
Fuel Pump Inlet and Fuel Return Line Thread Size	.....	7/16-24 NPTF
Fuel Pump Maximum Lift	.....	6 ft (1.83 m)
Ventilation (1800 rpm)		
Engine (radiator-cooled)	.....	3000 cfm (85 m³/min)
Generator	.....	160 cfm (4.5 m³/min)
Combustion	.....	53 cfm (1.5 m³/min)

TUNE-UP SPECIFICATIONS

Start-Disconnect Centrifugal Switch Point Gap	0.020 in (0.51 mm)
Cylinder Head Bolt Torque	44 - 46 ft-lb (60 - 62 n•m)
Glow Plug Torque	10 - 15 ft-lb (14 - 20 n•m)
Valve Clearances	
Intake	0.011 in. (0.28 mm)
Exhaust	0.016 in. (0.41 mm)
Injector Firing Order	1, 2, 4, 3
Oil Capacity	6.5 U.S. qts

Section 3. Description

CONTROL PANEL COMPONENTS

NOTE: Controls and instruments on the RDJC genset vary according to customer requirement.

Standard Features

- **Run-Stop-Remote Switch:** Starts and stops the genset locally or remotely.
- **Preheat Switch:** Activates the manifold heater and glow plugs.
- **Battery Charge Rate DC Ammeter:** Monitors the battery charging current.
- **Field Circuit Breaker:** Protects the exciter and the alternator if the voltage regulator malfunctions.
- **Oil Pressure Gauge:** Monitors engine lubricating oil pressure.
- **Water Temperature Gauge:** Monitors coolant temperature in the engine (wired to a sensor on the engine).
- **Cranking Limiter:** Thermally activated device limits cranking time to 45 - 90 seconds, depending on ambient temperature. At the end of the cranking period, a red pushbutton pops out, which cannot be reset until one minute has elapsed.

Optional Features

- **AC Voltmeter:** Monitors output voltage.
- **Voltmeter Phase Selector Switch:** Selects the output voltage phase to be measured.
- **Voltage Adjust Rheostat:** Adjusts output voltage 5%.
- **Running Time Meter:** Registers the total genset running time: used to time service intervals.
- **Frequency Meter:** Indicates the frequency (hz) of the output voltage. This meter can be used to determine engine speed (one hz equals 30 rpm).
- **Warning Lights:** Red warning lights indicate the following conditions:
 1. Engine failed to start
 2. Overspeed
 3. Low oil pressure
 4. High engine temperature
- **Reset Pushbutton:** Permits restarting after a fault condition is corrected.
- **Line Circuit Breakers:** Protects the generator from line overloads.

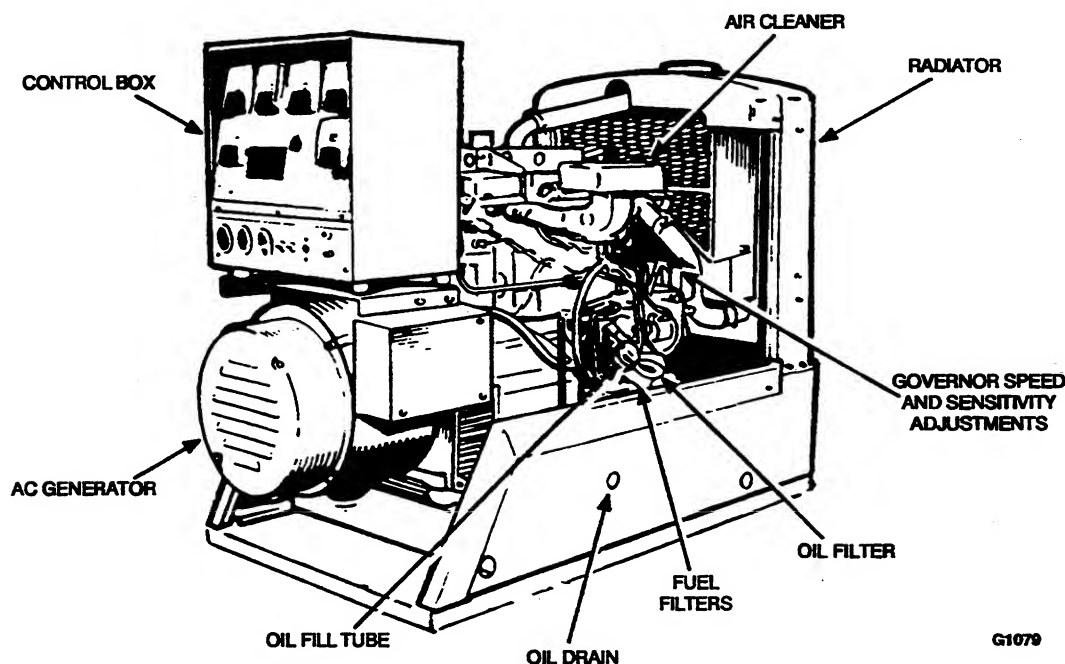


FIGURE 3-1. RDJC GENERATOR SET

VOLTAGE RECONNECTION WITH OPTIONAL INSTRUMENTS

The optional AC instruments on the control panel (voltmeters, running time meters, etc.) are used with specific output voltages. Different AC instruments may be nec-

essary to match new current ratings, when field recon-
nections are made for other voltages.

⚠ WARNING *Operating a generator set with output voltage incorrectly reconnected may cause equipment damage, severe personal injury or death. Contact a qualified electrician or an authorized Onan service representative for generator reconnection.*

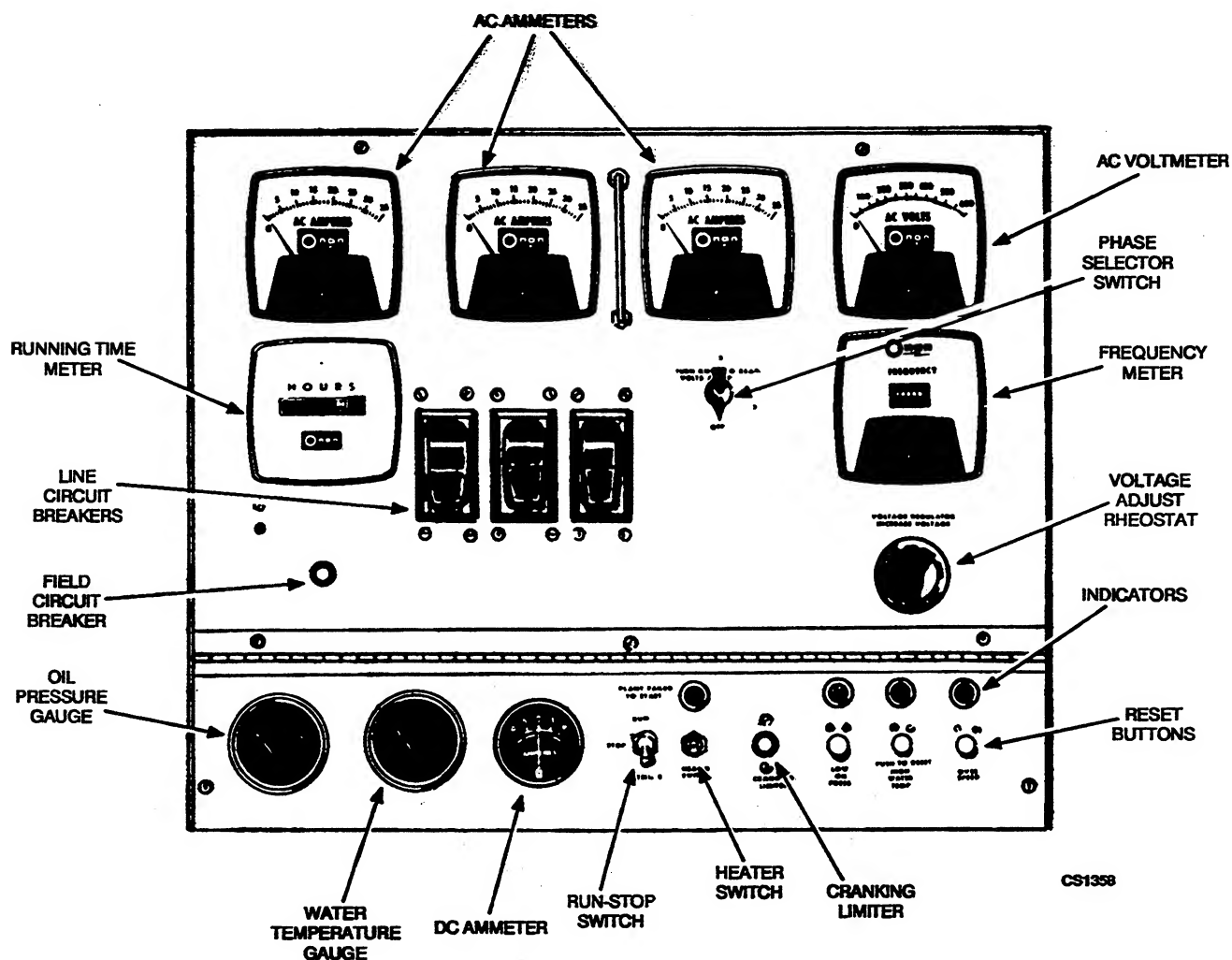


FIGURE 3-2. TYPICAL RADIATOR-COOLED SET CONTROL PANEL

Section 4. Installation

GENERAL

Generator set installations must conform to local building codes, fire ordinances, and other local, state and federal regulations (see Figure 4-1). For more detailed installation instructions, consult Onan Application Manual T-030, or contact an authorized Onan service representative.

Installation requirements include:

- Level mounting surface
- Adequate cooling air
- Adequate fresh induction air
- Discharge of circulated air
- Discharge of exhaust gases
- Electrical connections
- Fuel connections
- Accessibility for operation and servicing

- Isolation from vibration
- Minimal noise levels

⚠ WARNING *Incorrect installation, service, or parts replacement can result in severe personal injury, death, and/or equipment damage. Service personnel must be qualified to perform electrical and mechanical component installations and service. Installation must comply with all state and local codes.*

LOCATION

Provide a location for the generator set that is dry, clean, dust-free, well-ventilated, and protected from the weather.

The left side of the set, where generator air is discharged, requires 3 inches (76 mm) clearance from the wall, so the set can rock on its mounts. There should be at least 24 inches (610 mm) clearance around all other sides for service access.

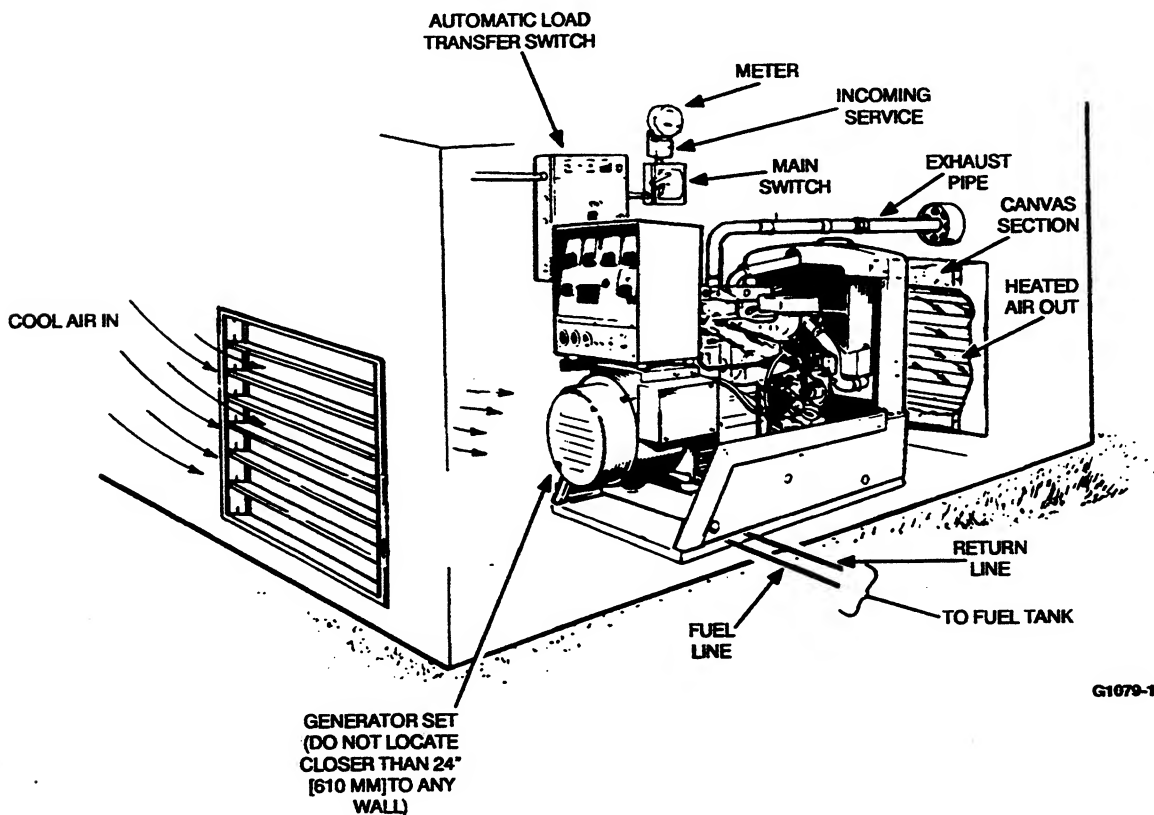


FIGURE 4-1. TYPICAL INSTALLATION

MOUNTING

A permanent genset installation should have a sturdy, level mounting base of concrete, heavy wood or structural steel. This base should be raised if possible, for easier oil changing and set operation. The set may be bolted into position.

On all installations, assemble the mounting cushions, washers and spacer bushing carefully. The spacer bushing prevents compression of the snubber (upper rubber cushion). Place the cushions (Figure 4-2) under the engine and generator mounting feet. Use cushions with a higher number (part number is shown on cushion) on the heavier generator end. Space the 3/8-inch diameter mounting bolts in the floor or the base with distances between hole centers as follows:

- Engine end: 11 inches (279.4 mm)
- Generator end: 10 1/2 inches (266.7 mm)
- Engine-to-generator: 21 inches (533.4 mm)

CAUTION *The oil filter can be punctured easily by the end of the mounting bolt. For this reason, provide at least 1/2-inch (12.7 mm) clearance between the oil filter and the end of the mounting bolt, to avoid puncturing the filter.*

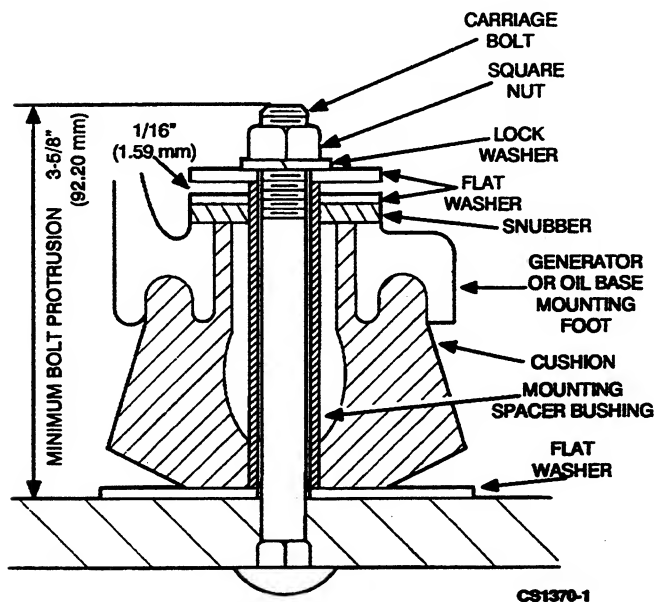


FIGURE 4-2. MOUNTING CUSHION INSTALLATION

VENTILATION

Generator sets create a large amount of heat, which must be removed by ventilation. An outdoor installation can rely on natural air circulation, but indoor installations need enough properly sized vents in the correct positions to maintain the necessary air flow.

The presence or absence of a fan and radiator determines ventilation system design. With a radiator, engine-pusher fan size is large enough to remove heat from the engine, generator, and a few feet (roughly a metre) of uninsulated exhaust pipe. Restrictive ducting or heat sources other than the generator set require extra fans to increase airflow.

With other cooling options, ventilation fans are needed. Fan size must be large enough to remove the heat in the room given off by the generator set, uninsulated exhaust pipes and any other heat-producing equipment. A temperature differential of 20° to 30° F (11° to 17° C) is usually satisfactory.

CAUTION *Generator set overheating can result in engine damage. To avoid this, never operate the generator set with any of the cooling system components removed.*

RADIATOR COOLING

Cooling air travels from the rear to the front of the set. Locate the room or compartment air inlet where it is most convenient, preferably to the rear of the set. The minimum inlet opening should be at least as 1-1/2 times the size of the radiator area. Increase the size of the opening if it will be restricted with louvers or filters (see Figure 4-1).

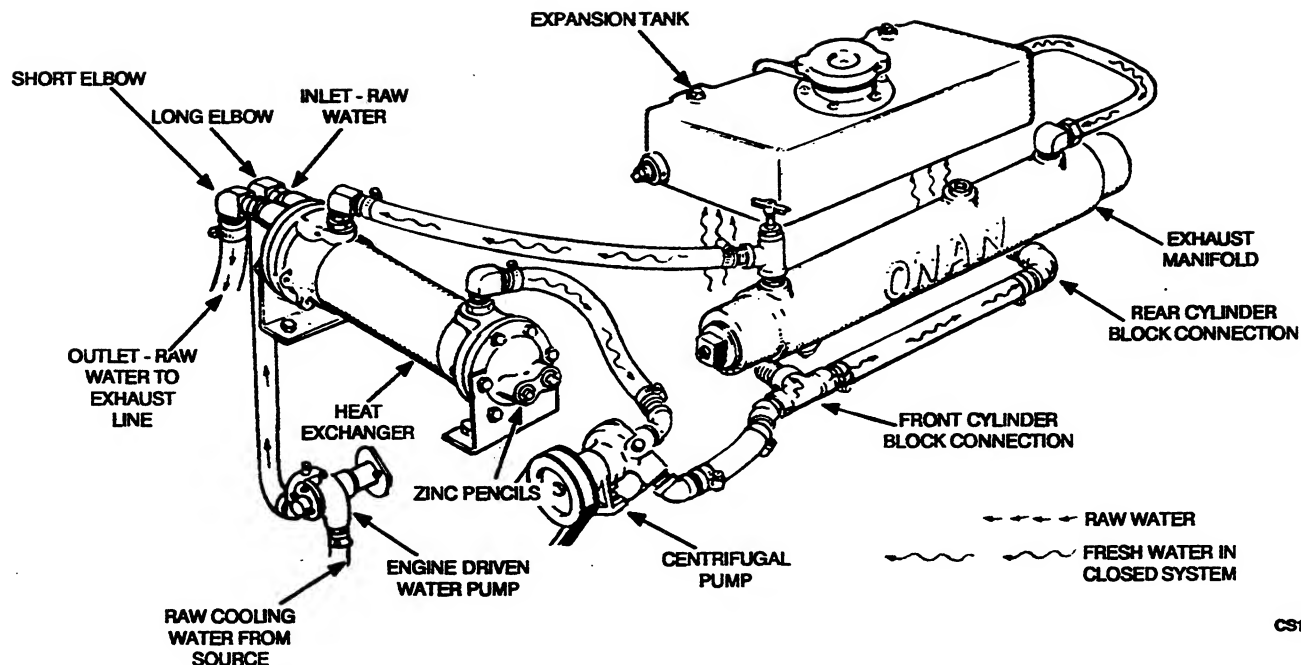
Engine heat is removed by a pusher fan which blows cooling air through the front of the radiator. The cooling air outlet should be directly in front of the radiator, and as close to it as is practical. The unrestricted outlet opening must be at least as large as the radiator opening. A flexible section must connect the radiator and the air outlet opening, to prevent recirculation of heated air.

Generator cooling air is discharged through the engine-to-generator adapter on the left side of the engine.

CAUTION *Generator set overheating can result in engine damage. To avoid this, never operate the generator set with any of the cooling system components removed.*

HEAT EXCHANGER COOLING (OPTIONAL)

This closed cooling system is commonly referred to as fresh water cooling (Figure 4-3). Water circulated through the engine is called fresh water, hot water, jacket water, etc. Water circulated only through the heat exchanger is called raw water, cold water, city water, etc. This system, with anti-freeze coolant, is recommended if freezing hazards exist.



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FIGURE 4-3. HEAT EXCHANGER PLUMBING

Two conditions are possible:

- Factory-installed heat exchanger
- Customer-installed Onan heat exchanger

Consult an Onan distributor for further information.

CAUTION A hot engine risks overflow and loss of coolant, leading to overheating and subsequent engine damage. Use an expansion tank in the closed water system to maintain the proper water level.

Fill a closed cooling system with clean, alkali-free water to the proper level in the expansion tank. Add an approved rust inhibitor to the coolant. If the coolant is anti-freeze, test it periodically.

Install a new zinc "pencil", which screws into the raw water inlet end of heat exchanger, every two months, or more often if required.

Use a metal centrifugal impeller water pump (Oberdorfer 1- GP, or the equivalent) in the hot water side of the system. Drive it with a belt from the engine power takeoff.

CITY WATER COOLING (OPTIONAL)

In city water-cooled sets, a conventional radiator is not used: a constant water flow cools the engine. Air movement and fresh air must be sufficient to cool the generator and support combustion. In small compartments, a duct size larger than the generator outlet opening is advisable, to remove heated air from the generator to the outside. Limit bends, and use radius-type elbows where

needed. A large, well-ventilated compartment or room does not require a hot air duct. Water-cooled exhaust manifolds are recommended.

Engine connections are 3/8 inch pipe. A solenoid shut-off valve and a manual supply valve are furnished, but not installed. The solenoid valve is coordinated with the engine control, to shut off the water supply when the set is not in use.

The manual supply valve is adjusted for proper cooling with a minimum flow of water. Final adjustment should be made under the maximum load the set will carry, with the engine thoroughly warmed up and the water temperature stabilized.

EXHAUST

Pipe exhaust gases outside the enclosure. The exhaust outlet fits a 1-1/2 inch pipe. Locate the exhaust outlet as far as possible from the air inlet, to keep gases from reentering the enclosure. Use seamless flexible tubing to connect the engine exhaust to a rigid pipe extension, if used, to prevent transmission of vibration.

WARNING Inhalation of exhaust gases can result in severe personal injury or death. Modifying the exhaust system can allow poisonous exhaust gases to escape. Use only original equipment replacement parts when servicing the exhaust system. Unauthorized modifications will also void the warranty and cancel the UL Listing/CSA Certification. Liability for injury or damages due to unauthorized modifications becomes the responsibility of the person making the change.

Because an exhaust system is subjected to detrimental conditions such as extreme heat, infrequent operation, and light operating loads, inspect the exhaust system frequently to ensure that it remains fume-tight and safe.

⚠WARNING *Exhaust gas presents the hazard of severe personal injury or death. Exhaust gas can easily leak from a faulty manifold. To reduce this risk, do not use exhaust manifold heat to warm a room or compartment occupied by people.*

An approved thimble must be used (Figure 4-4) to pass exhaust pipes through walls or partitions. Build this thimble according to code (see National Fire Protection Asso-

ciation bulletin, Volume 4, section 211 on "Standards for Chimneys, Fireplaces, and Vents").

As the exhaust pipe length and number of bends increases, a larger pipe is required, to reduce excessive exhaust restriction and back pressure.

Table 4-1 shows the maximum equivalent exhaust pipe lengths for exhaust systems using 1-1/2 inch through 3 inch pipes. Also shown are the equivalent lengths of various pipe fittings. The total exhaust system equivalent length, including all fittings and muffler, must not exceed the length shown in Table 4-1 for the pipe size used. Exceeding the maximum length causes excessive back pressure. Maximum allowable back pressure measured at the exhaust manifold is 27.2 inches (691 mm) H₂O.

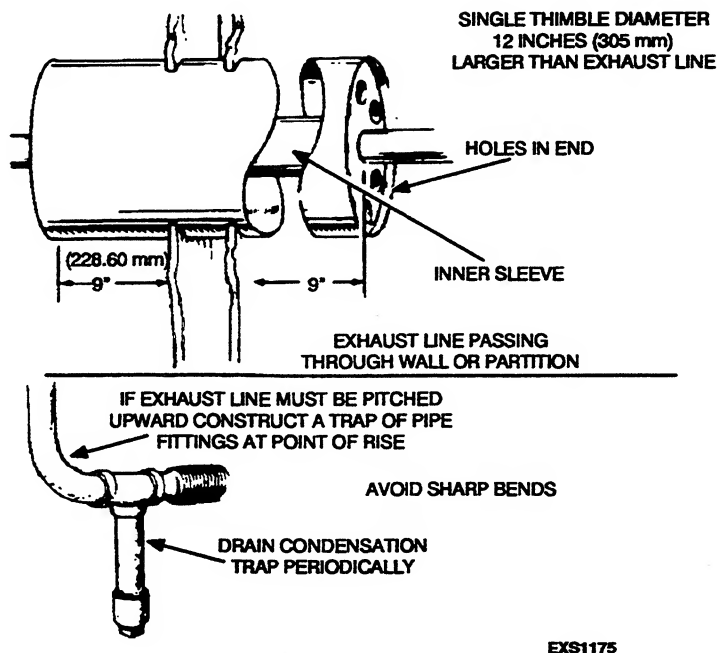


FIGURE 4-4. EXHAUST PIPING

TABLE 4-1. EXHAUST LENGTH
MAXIMUM EQUIVALENT EXHAUST PIPE LENGTH
ONE CRITICAL MUFFLER INCLUDED

PIPE SIZE (INCHES)	1.5	1.75	2.0	2.5	3
MAXIMUM PIPE LENGTH IN FEET	14 (4.3)	28 (9)	56 (17)	148 (45)	466 (142)

(Metres in Parentheses)

(Max. Allowable Back Pressure is 27.2 Inches (691 mm) H₂O)

EQUIVALENT LENGTHS OF PIPE FITTINGS

TYPE FITTING Inches	1.5	2	2.5	3
STANDARD ELBOW Feet (Metres)	4.4 (1.34)	5.3 (1.62)	6.4 (1.95)	8.1 (2.47)
LONG RAD. ELBOW Feet (Metres)	2.8 (0.85)	3.5 (1.07)	4.2 (1.28)	5.2 (1.58)
MED. RAD. ELBOW Feet (Metres)	3.6 (1.10)	4.6 (1.40)	5.4 (1.64)	6.8 (2.07)
STANDARD TEE Feet (Metres)	9.3 (2.83)	13 (3.96)	14 (4.27)	17 (5.18)

FUEL TANK AND LINES

The top of the fuel tank must be lower than the fuel pump to prevent siphoning if a system leak occurs. Install a shutoff valve at the fuel tank, to enable servicing. If the fuel tank is shared, do not connect it to an existing line at a point above the fuel supply level, to avoid starving either engine.

⚠ WARNING *Explosion and fire can cause severe personal injury or death. Because fuel leaks create fire hazards, always use flexible tubing between the engine and the fuel supply, to avoid leaks due to vibration and/or fuel line failure. Do not allow the fuel line to contact rough, sharp or hot surfaces.*

Use an approved flexible fuel line next to the engine. Diesel engines require a fuel supply line and a separate fuel return line. Install the fuel supply line from the supply tank to the inverted flare male elbow mounted in the inlet of the fuel pump. Install the fuel return line from the injection pump bleeder valve to the supply tank (Figure 4-5). Shield the line with fire-retardant material if it passes through a combustible wall or partition.

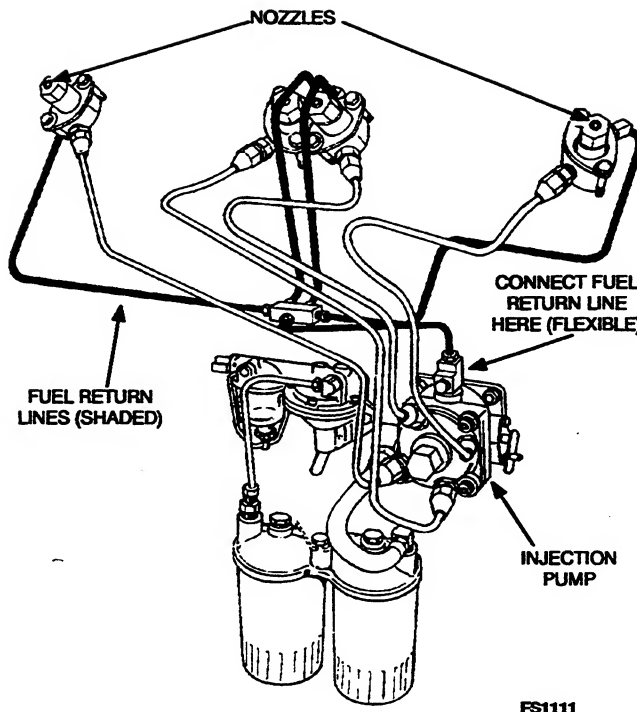


FIGURE 4-5. FUEL SYSTEM

OIL DRAIN

Extend the drain to suit the installation. The oil base has a 1/2-inch pipe size tapped hole.

⚠ WARNING *Fire presents the hazard of severe personal injury or death. To reduce fire hazard, do not position the oil drain so that oil might drip onto the muffler, any exhaust components, or any other hot parts.*

SEPARATE FUEL TANKS

The fuel tank top must be lower than the fuel pump level, to prevent putting a static head on the fuel pump inlet. If the fuel tank is shared with another engine, use separate fuel lines for both engines, to avoid starving either one.

The following restrictions apply to separate fuel tank installation:

1. The bottom of the fuel tank must not be more than 6 feet (1.8 m) below the fuel transfer pump inlet, unless an auxiliary electric fuel pump is added. The maximum lift capacity of the transfer pump is six feet. See the Wiring Diagram for the connection.
2. If the tank is installed above the fuel pump inlet level without a supply line shutoff valve, a ruptured pump diaphragm could cause oil dilution, fuel loss, and fuel leakage to the crankcase.
3. If the maximum fuel lift must be exceeded on any installation, consult Onan Application Manual T-030

for information on installing a day tank and an electric solenoid shutoff valve.

4. Use an electric or manual shutoff valve if the minimum fuel level in the tank is higher than the pump inlet, to provide positive fuel shutoff when the engine is stopped. This valve also prevents loss of fuel from possible leaks between the tank and the fuel pump.

⚠ WARNING *Fuel leaks create the hazard of explosion and fire, which can cause severe personal injury or death. For these reasons, always use flexible tubing between the engine and the fuel supply, to avoid leaks due to vibration and/or fuel line failure. Make certain that the fuel system and the fuel tank location meet applicable local codes.*

FUEL CONNECTION

Connect the fuel line to the fuel pump inlet. The inlet is threaded 7/16-24 NPTF (American Standard Internal Tapered Pipe Thread).

⚠ WARNING *Explosion and fire can cause severe personal injury or death. Because fuel leaks create fire hazards, always use flexible tubing between the engine and the fuel supply, to avoid leaks due to vibration and/or fuel line failure.*

The engine requires a fuel supply line and a separate fuel return line. Install the fuel return line from the 7/16-24 opening in the overflow fitting on the injection pump (where the nozzle fuel return line is also connected) to the top of the fuel supply tank. See Figures 4-1 (Typical Installation) and 4-4 (Exhaust Piping).

Carefully clean all fuel system components before operating the set. Dirt or contamination can cause major damage to the fuel injection system.

ELECTRICAL CONNECTIONS

The nameplate on the genset lists its electrical output rating in watts, volts, and hertz. The wiring diagram, shipped with the set, depicts the electrical circuits and connections for installation.

All electrical connections should be made by an electrician or a qualified Onan technician, to meet the local electrical code requirements.

⚠ WARNING *Electrical shock can cause severe personal injury or death. Do not touch electrical wiring or components during testing. Disconnect electrical power by removing starting battery negative (-) cable before handling electrical wiring or components.*

Load Wires

The control box (junction box) has knockout sections to accommodate load wires. Use flexible conduit and stranded load wires near the set, to isolate vibration. Use the correct size insulated wires for the load rating applied.

Connect each load wire to the proper generator output lead inside the control box. Insulate the bare ends of the ungrounded wires. Use the bolt provided on the control box to connect the generator ground lead or earth wire. Install a fused main switch (or circuit breaker) between the generator and the load. If a test run indicates the wrong rotation of 3-phase motors in the load circuit, switch the connections at any two of the generator terminals.

⚠ WARNING *Electrical shock can cause severe personal injury or death. Check voltage at the nearest junction box to be sure power has been disconnected before disconnecting load wires.*

⚠ CAUTION *An excessive electrical load can damage the generator windings. Divide loads equally between the output leads to prevent generator damage.*

Standby

If the genset is being installed for standby service, add a manual or automatic double-throw transfer switch to avoid feeding generator output into the normal power source lines, and to prevent commercial power and generator output from being connected to the load at the same time. See the transfer switch installation manual for connection instructions. Also see Figure 4-6.

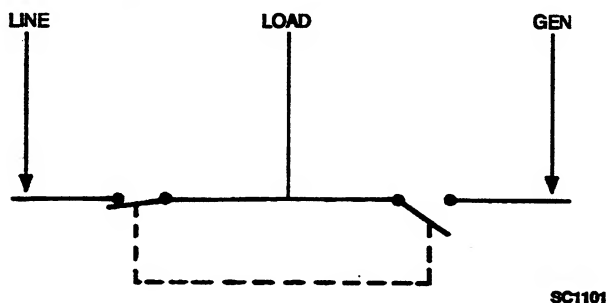


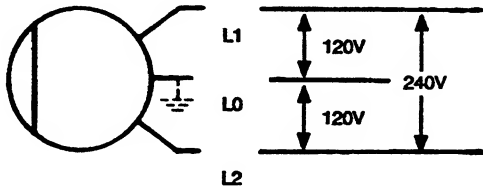
FIGURE 4-6. LOAD TRANSFER SWITCH (TYPICAL FUNCTION)

BALANCING LOADS

⚠ WARNING *Electrical shock can cause severe personal injury or death. Do not touch electrical wiring or components during testing. Disconnect electrical power by removing starting battery negative (-) cable before handling electrical wiring or components.*

120/240 Volt, Single Phase: Terminal connection L0 (neutral) may be grounded, if required. For 120 volts,

connect the hot load wires to either the L1 or L2 connection, Figure 4-7. Connect the neutral load wire to the L0 connection. Two 120 volt circuits are thus made available, with not more than 1/2 the rated capacity of the set available on either circuit. If using both circuits, be sure to balance the load between them.

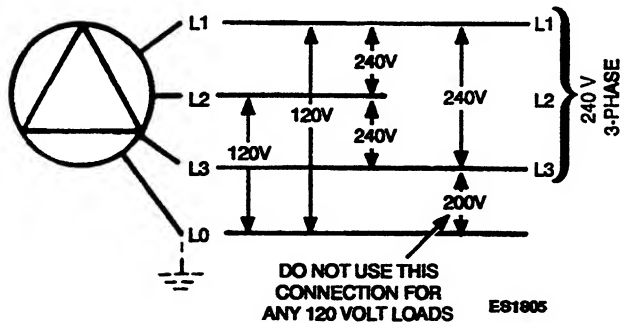


ES1804

FIGURE 4-7. 120/240 VOLT, SINGLE PHASE

For 240 volts, connect one load wire to the L1 connection and the second load wire to the L2 connection. Terminal connection L0 is not used for 240 volt service.

120/240 Volt, 3 Phase, 4 Wire Delta Connected Set: The 3- phase delta connection is designed to supply 120 and 240 volt, 1 phase current and 240 volt, 3 phase current (Figure 4-8). In 3-phase operation, connect the three load wires to generator terminals L1, L2 and L3 - one wire to each terminal. In 3-phase operation, the L0 terminal is not used.



ES1805

FIGURE 4-8. 3 PHASE, DELTA CONNECTION

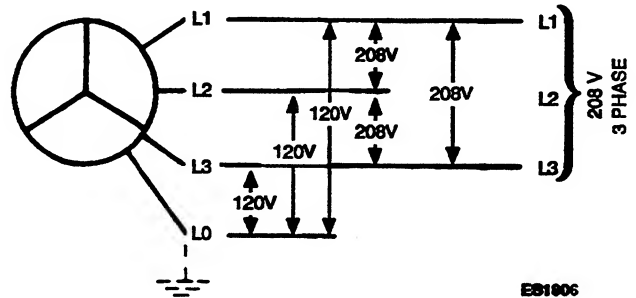
For 120/240 volt, 1-phase, 3-wire operation, terminals L1 and L2 are the "hot" terminals. The L0 terminal is the neutral, which can be grounded if required. For 120 volt service, connect the black load wire to either the L1 or L2

terminal. Connect the neutral (white) wire to the L0 terminal. Two 120 volt circuits are available.

Any combination of 1-phase and 3-phase loading may be used at the same time, if no terminal current exceeds the nameplate rating of the generator. If no 3-phase output is used, usable 1-phase output is 2/3 of 3 phase kVA.

3 Phase, 4 Wire, Wye-Connected Set: The 3 phase, 4 wire connection produces line-to-neutral voltage and line-to-line voltage. The line-to-neutral voltage is the lower voltage as noted on the unit nameplate, and the line-to-line voltage is the higher nameplate voltage.

For 3-phase loads, connect separate load wires to each of the set terminals L1, L2 and L3. Single-phase output of the higher nameplate voltage is obtained between any two 3-phase terminals as shown in Figure 4-9.



ES1806

FIGURE 4-9. 3 PHASE, WYE CONNECTION

The terminal marked L0 may be grounded if required. For 1- phase loads, connect the neutral (white) load wire to the L0 terminal. Connect the black load wire to any one of the other three terminals - L1, L2 or L3. Three separate 1- phase circuits are available, with not more than 1/3 the rated capacity of the set available at any one circuit.

If using 1-phase and 3-phase current at the same time, use care to properly balance the 1 phase load, and not to exceed rated line current.

Figure 4-9 shows load connections for 120/208 voltage. Other voltages are available from either parallel wye or series wye, illustrated in Figure 4-10.

NAMEPLATE VOLTAGE CODE					GENERATOR CONNECTION SCHEMATIC DIAGRAM			LOAD-TO-GENERATOR CONNECTIONS CONNECT X1 TO TERMINAL 5 OF PRINTED CIRCUIT BOARD FOR 50 HZ, TO TERMINAL 6 FOR 60 HZ		
VOLTAGE					PHASE			FREQUENCY		
CONNECT W/0 JUMPER WIRE FROM V4 TO:					GENERATOR CONNECTION					
J	120/240	I	60	V1						
P	120/240	I	50	V1						
	115/230	I	50	V2						
	110/220	I	50	V3						
L	120/208	3	60	V1						
Z	110/190	3	50	V1						
	115/200	3	50	V2						
	120/208	3	50	V3						
	127/220	3	50	V4						
L	240/416	3	60	V1						
Z	220/380	3	50	V1						
	230/400	3	50	V2						
	240/416	3	50	V3						
	254/440	3	50	V4						
L	120/240	3	60	V1						
Z	110/220	3	50	V1						
	115/230	3	50	V2						
	120/240	3	50	V3						
L	120/240	I	60	V1						
Z	110/220	I	50	V1						
	115/230	I	50	V2						
	120/240	I	50	V3						
L	120/240	I	60	V1						
Z	110/220	I	50	V1						
	115/230	I	50	V2						
	120/240	I	50	V3						
L	120	I	60	V1						
Z	110	I	50	V1						
	115	I	50	V2						
	120	I	50	V3						
H	347/600	3	60	V1						

B200

FIGURE 4-10. GENERATOR WIRING AND CONNECTION DIAGRAMS

GROUNDING

Typical requirements for bonding and grounding are given in the National Electrical Code, 1990, Article 250.

Periodic inspection is recommended, especially after service work has been performed on equipment anywhere in the electrical system.

Generator Set Bonding and Equipment Grounding

Bonding is defined in the National Electrical Code, 1990, Article 100, as: The permanent joining of metallic parts to form an electrically conductive path which will assure electrical continuity to conduct safely any current likely to be imposed.

⚠WARNING *Abnormal system conditions may allow ungrounded metallic parts to be energized, bringing about the risk of severe personal injury or death. Bonding and equipment grounding must be done correctly for proper system operation and operator safety.*

Circuit and System Grounding

The design and installation of grounding systems involves many factors, including multiple transformers, standby generators, ground fault protection, physical locations of equipment, and conductor type and size. Although the consulting engineer and installer are responsible for the design and wiring of each particular grounding application, system grounding must conform to national and local codes.

Output Lead Markings

Leads on revolving field generators are marked T1, T2, etc. These identifying marks also appear on the wiring diagram.

SWITCHBOARD

⚠WARNING *Electrical shock can cause severe personal injury or death. Use extreme caution when working on electrical circuitry. Attach and remove switchboard leads only when generator set is not operating. Make certain that the generator set is inoperative by disconnecting the negative (-) battery cable. Do not touch leads during operation of generator set.*

A optional wall-mounted switchboard contains ammeters, a voltmeter, and circuit breakers. If it is used, the following connections apply:

1. Connect one ungrounded (hot) generator lead to the unused terminal on each ammeter.

2. Connect the generator lead and load wires to be grounded to the ground stud on the switchboard.
3. Connect one ungrounded (hot) load wire to the unused terminal on each circuit breaker.
4. On sets that generate more than one voltage (example: 120/240), wire the voltmeter to indicate the higher voltage.

RECONNECTIBLE GENERATORS

The factory ships special-order sets with control panels especially wired for the voltage specified by the customer. Standard sets without instruments are shipped with the T1-T4 or T1-T12 output leads separated in the output box. These single-phase and broad-range generators may be connected to provide any of the output voltages shown in Figure 4-10. Grounding or earthing procedures should comply with local electrical codes.

⚠WARNING *Electrical shock can cause severe personal injury or death. Never remove the grounding pin from electrical equipment. Incorrect ground or no ground can cause the installation to become electrically "hot". Equip the installation with adequate Ground-Fault Circuit Protection devices to meet the National Electrical Code (NFPA 70, 551-7[C]) and to provide personal safety.*

Code 3C or 53C Reconnectible Generators: The single-phase, 60- and 50-hertz generators have output leads T1, T2, T3 and T4 available to make the single phase voltage and load connections shown in Figure 4-10 at the installation site.

Code 18 or 518 Reconnectible Generators: The three-phase, broad-range, 60 and 50 hertz 12-lead generators have output leads T1 through T12 available to make the single and three phase voltage load connections shown in Figure 4-10.

When connecting the output leads, be sure to connect jumper W10 on the voltage regulator printed circuit board between terminal V4 (common) and V1, V2, or V3 as listed on the reconnection diagram.

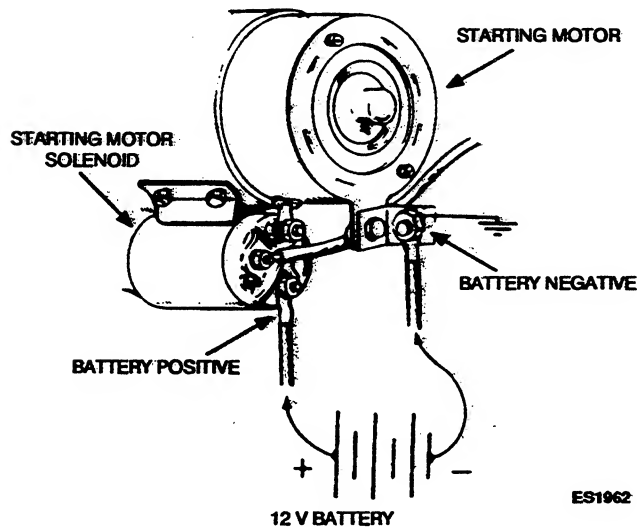
Code 9x Generators: These special-order three-phase, 60 hz, 4-wire generators are rewired at the factory to provide 347/600 VAC. Output leads T1, T2, T3 and T0 are available for connection to the load wires. See connection diagram, Figure 4-10.

BATTERY CONNECTIONS

The battery is connected for negative (-) ground, Figure 4-11. Be sure all battery connections are tight.

Battery polarity must agree with the rectifier in the control box. If battery polarity must be changed, reverse the rectifier connection in the control box.

⚠ WARNING Batteries present the hazard of explosion, which can result in severe personal injury. Disconnecting battery cables from the battery while the generator set is cranking or running causes arcing. For this reason, do not disconnect battery cables from the battery while the generator set is cranking or running. To minimize arcing, always disconnect the negative (-) cable first, and connect it last.



CABLE SIZE

mm	6.5	7.3	8.3	9.3	10.5	11.6
INCH	.258	.289	.325	.365	.410	.460
WIRE SIZE	2	1	0	00	000	0000
LOOP	4 ft 1.24 m	5 ft 1.55 m	7 ft 2.17 m	9 ft 2.79 m	11 ft 3.41 m	14 ft 4.34 m

FIGURE 4-11. BATTERY CONNECTIONS AND CABLE DIMENSIONS

⚠ CAUTION Reversed battery polarity can damage or destroy the generator within 3 minutes if stopped, or within 5 seconds if running. With reversed polarity, alternator windings will be damaged almost instantly if the battery charging circuit is shorted between resistor R21 and the B1 end of the charging winding. Make certain that battery polarity is correct, to avoid damaging or destroying the system.

See the Specifications section of this manual for the 12 volt battery minimum requirements. Connect battery positive (+) to starter engaging solenoid terminal post, Figure 4-11. Connect battery negative (-) to a solid ground connection on the engine.

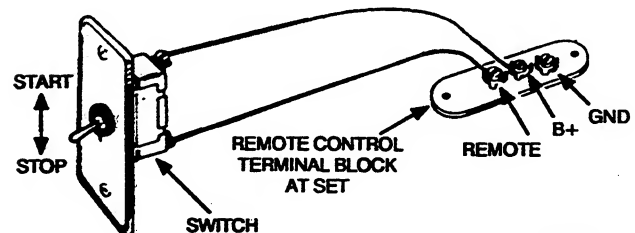
OPTIONAL ALARM

The GND terminal on the remote control terminal block is intended for a customer-supplied alarm at a remote location, to warn of emergency shutdown. Refer to the Wiring Diagram for proper alarm connections.

REMOTE START-STOP SWITCH (Optional)

Use 2 wires to connect the SPST remote start-stop switch to the terminal block marked B+ and to the remote in the control box, using the wire sizes listed in Figure 4-12.

⚠ CAUTION Incorrect connections can damage the control, the remote switch, and the interconnecting wiring. Ensure that the leads from the remote switch connect with the corresponding terminals on the generator set.



WIRE SIZE	DISTANCE
#18	to 900 ft (279 m)
#16	to 1500 ft (465 m)
#14	to 2400 ft (744 m)
#12	to 3700 ft (1147 m)

FIGURE 4-12. REMOTE CONTROL

Section 5. Operation

PRE-STARTING

Preparation for initial and subsequent starts includes careful checks of the oil, fuel, cooling, and electrical systems. Close the cylinder air housing door with all air shrouds in place.

Before the generator set is activated, check all components for mechanical integrity. If an abnormal condition, defective part, or operating difficulty is detected, repair or service the genset as required. Keep the generator set free of dust, dirt, and spilled oil or fuel.

⚠WARNING *Accidental starting of the generator set can cause severe personal injury or death. Make certain the generator set is stopped and disconnect the starting battery cables (negative [-] cable first) before inspecting the generator set.*

Oil Recommendations

The use of quality engine lubricating oils combined with appropriate oil drain and filter change intervals are critical factors in maintaining engine performance and durability.

Use 15W-40 multi-viscosity oil that meets the American Petroleum Institute (API) Classification of CE/SF. CD/SF oil may be used in areas where CE/SF oil is not available. CE and CD oils are designed for high temperature, severe duty service.

A maximum sulfated ash content of 1.85 mass % is recommended to prevent guttering and valve burning.

The use of a multi-viscosity lubricating oil has been found to improve oil consumption control and improve engine cranking in cold temperatures while maintaining lubrication at high operating temperatures. While 15W-40 oil is recommended for most climates, refer to the accompanying table for oil viscosity recommendations for extreme climates.

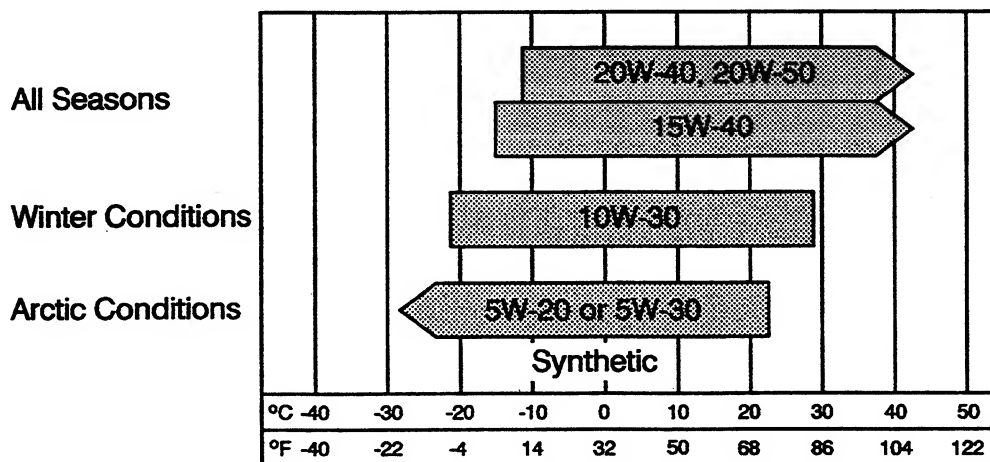
⚠CAUTION *Limited use of low viscosity oils, such as 10W-30 may be used for easier starting and providing sufficient oil flow at ambient temperatures below -5° C (23° F). However, continuous use of low viscosity oils can decrease engine life due to wear. Refer to the accompanying chart.*

If an engine is operated in ambient temperatures consistently below -23° C (-10° F) and there are no provisions to keep the engine warm when it is not in operation, use a synthetic CE/SF or CD/SF engine oil with adequate low temperature properties such as 5W-20 or 5W-30.

⚠CAUTION *The use of a synthetic base oil does not justify extended oil change intervals. Extended oil change intervals can decrease engine life due to factors such as corrosion, deposits and wear.*

In extremely dusty or dirty conditions, oil should be changed more frequently. When adding oil between changes, use the same brand as already in the engine. Various brands of oil may not be compatible when mixed. Refer to the Maintenance section of this manual for oil change interval and procedures. Always change the oil filter when changing the oil.

TABLE 5-1. SAE OIL VISCOSITY RECOMMENDATIONS



Anticipated Ambient Temperature

Oil capacity is 6 U.S. quarts, plus 1/2 quart for the oil filter. Fill the crankcase until the oil reaches the "FULL" mark on the oil level indicator (see Figure 5-1).

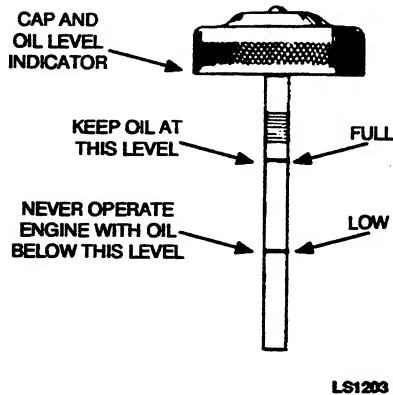


FIGURE 5-1. OIL LEVEL INDICATOR

⚠ WARNING Hot oil may cause severe burns by blowing out from the oil fill tube of a running generator set. Do not check the oil level while the generator set is running.

Recommended Fuel

Use ASTM 2-D or 1-D fuel, with a minimum Cetane number of 45*. Number 2 diesel fuel is usually most economical; however, use ASTM 1-D fuel during the following conditions:

1. When ambient temperatures are below 32° F (0° C)
2. During long periods of light engine load or no load

NOTE: Fuels with Cetane numbers higher than 45 may be necessary in higher altitudes or in extremely low ambient temperatures, to prevent misfires.

Use fuel with a low sulfur content and a pour point (ability to filter) of at least 10°F (6°C) below the lowest expected ambient temperature. Keep fuel clean and protected from adverse weather. Leave room for fuel expansion when filling the fuel tank.

⚠ CAUTION Dirt in the system can severely damage both the injection pump and the injection nozzles. Because diesel injection systems have extremely precise tolerances, make certain that fuel is kept clean.

Bleeding Fuel System

Bleed air from fuel system as follows: Disconnect the fuel return line (Figure 5-2). Operate the hand priming lever on the fuel transfer pump until the fuel flowing from the fuel return line is free of air bubbles. Then reconnect the fuel return line. Cranking the engine should expel trapped air from the injection pump.

ALWAYS RETURN
PRIMER LEVER TO
LOWEST POSITION

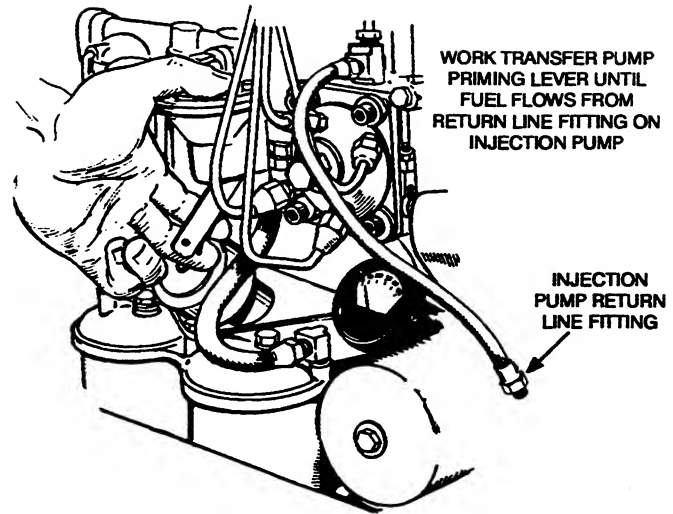


FIGURE 5-2. FUEL SYSTEM

If the camshaft's pump lobe is up, crank the engine one revolution to permit hand priming. When finished, return priming lever inward (disengaged position) to permit normal pump operation.

PRE-HEATING AND STARTING

Preheat the engine for 60 seconds when the ambient temperature is 55°F (13°C) or lower. Preheat the engine for 30 seconds in temperatures above 55°F (13°C).

To preheat the engine:

1. Engage the preheat switch for one minute.
2. Release the preheat switch and engage the start switch.
3. Release the start switch after the engine reaches speed.
4. Check the oil pressure gauge: it should read at least 20 psi (138 kPa).

NOTE: the pressure-relief valve is not adjustable.

5. If the engine fails to start after 20 seconds of cranking, wait one minute to conserve the battery, then repeat step 2. Absence of blue exhaust smoke during cranking indicates that no fuel is reaching the engine.
6. In extreme cold (below 32°F or 0°C) it may be necessary to maintain preheating for two minutes after the engine starts, to obtain firing or smooth out cylinders, especially at no load or light loads.

NOTE: When remotely starting the set, the switch on the set control must be in its remote position.

⚠ CAUTION *Preheating the engine longer than one minute before cranking the engine can destroy the manifold heater and glow plugs, because there is no incoming air flow to cool them. For this reason, do not exceed the one minute preheat periods, to prevent heater burnout and conserve the battery.*

NOTE: Operating the preheaters for a few seconds during cranking in cold weather helps preheat the incoming combustion air, to prevent misfires as the engine starts running.

When the engine reaches operating speed, the centrifugal switch and the start-disconnect relay automatically stop cranking. If the engine fails to start in 45 to 120 seconds, the cranking limiter trips and stops cranking. If this occurs, wait one minute before resetting the cranking limiter and trying to restart the engine.

NOTE: Depress the preheat switch for one minute, then release it and push the start switch.

If the control has an emergency relay reset button, perform reset only after a shutdown occurs due to low oil pressure or high water temperature. Make certain to find the cause of the failure before restarting the engine.

⚠ CAUTION *Overvoltage will destroy the glow plugs and air heater in 2 to 3 seconds. If extra power is needed to start the set, connect an additional 12 volt battery in parallel to the starting battery. Do not apply overvoltage to the starting circuit at any time.*

Radiator: See Specifications for water capacity. Make certain that the radiator drain valve is closed and that the cylinder block drain plug is tight. Fill the radiator with clean, soft (alkali free), preferably distilled water. The use of a good rust and scale inhibitor is recommended.

If the set will be exposed to freezing temperatures, use a solution of standard anti-freeze. Use the proportion of anti-freeze recommended by its manufacturer, to protect to at least 10°F (6°C) below the lowest expected temperature.

STOPPING

1. Push the start-stop switch to the stop position.
2. If the stop circuit fails, push governor arm down to shut off fuel injection pump.

APPLYING LOAD

Allow the set to warm up before connecting a heavy load. Continuous generator overloading may cause high operating temperatures that can damage the windings. Keep the load within the nameplate value for normal operation. Carbon deposits may form on the exhaust system during operation at light loads; apply full load occasionally before shutdown to prevent excessive carbon accumula-

tions. When possible, connect the load in small increments, instead of fully loading the genset at once.

BREAK-IN PROCEDURE

⚠ CAUTION *Continuous generator set overloading can cause high operating temperatures that could damage the generator windings. Keep the load within the nameplate rating.*

Observe the following schedule for genset break-in:

1. One half hour at 1/2 load.
2. One half hour at 3/4 load.
3. Full load.

Do not run the generator set continuously under one half load during the first few hundred hours of operation. This usually results in poor piston ring seating, causing higher-than-normal oil consumption and blowby.

Drain and replace the crankcase oil after the first 50 hours of operation. Do this while the engine is still hot.

SAFETY DEVICES

In case of dangerously high coolant (water) temperature or low oil pressure, the cutoff switch stops the unit. After an emergency stop, investigate and correct its cause. Press the reset button on the control panel before restarting.

⚠ WARNING *Hot oil or coolant can cause severe personal injury. Do not check the oil or coolant level while the generator set is running; wait until the generator set is cool before investigating.*

EXERCISING UNIT

Infrequent use of the generator set can cause it to deteriorate. The following can occur:

- Condensation in the fuel and lubrication system, causing contamination and/or corrosion
- Loss of protective oil film on moving engine parts
- Loss of engine fuel prime due to drain-back and/or evaporation
- Battery discharge due to internal and external current leakage
- Breakdown of generator insulation due to water absorption

Proper exercising does the following:

- Elevates engine oil temperature to at least 180°F (82.2°C)

- Evaporates water from engine lubrication system
- Reestablishes a protective oil film on engine parts
- Recharges battery to full normal potential
- Brings generator to normal operating temperature through load application

The generator set should be exercised at least once each week: the engine oil temperature should be held at 180°F (82.2°C) for at least 20 minutes during this exercise.

To exercise the generator set, do the following:

1. Perform all required maintenance checks, start the unit, and apply a load by creating a simulated power failure*. This exercises the control and switchgear systems.
2. Apply at least 50 percent load, using the thermostatic shutters if needed, to heat the engine and generator, as described above.
3. Exercise the unit long enough to provide at least 20 minutes running time at normal operating temperatures. This requires at least 60 minutes total running time.
4. Shut the unit down by simulating the return of normal power*. Run the set for approximately 10 minutes with no load to allow the engine to cool down.

* This applies to a standby genset only. Other units should be started and loaded by control and load application systems normally associated with operation of the unit.

CAUTION *Improper exercising may cause more damage than no exercising at all. Significant amounts of water and raw fuel will remain in the lubrication oil if the unit is run at a low operating temperature. Also, operating the engine at no load or at low temperatures causes carbon buildup and exhaust system fouling. Continued operation in this manner may cause starting failure and/or engine damage. Exercising a generator set without exercising its associated controls and switchgear does not test the operation of the controls and switchgear. If the control systems are not fully functional, the system may fail to provide power when required.*

After each exercise period, refill the fuel tank and check the engine for leaks and overall condition. Locate the cause of any leaks and correct.

ENGINE RATINGS

Ratings apply to altitudes up to 1000 feet (305 m), gensets using standard cooling, normal ambient tempera-

tures and with No. 2 Diesel fuel. Consult the nearest authorized Onan service center for operating characteristics under other conditions.

HIGH TEMPERATURES

1. Make certain that nothing obstructs air flow to and from the set.
2. Be sure that the set location is properly ventilated.
3. Check the level of battery electrolyte frequently, and add approved water when necessary to maintain the proper level.
4. Keep the cooling system clean and the radiator filled, and see that the fan belt tension is properly adjusted.

LOW TEMPERATURES

1. Use the correct viscosity oil for the prevailing temperature. Change oil only when the engine is warm. If an unexpected temperature drop causes an emergency, move the set to a warm location or apply externally heated air until the oil flows freely (never use an open flame).
2. Use fresh fuel, and protect against moisture condensation.
3. Keep the fuel system clean, and maintain the batteries in a well-charged condition.
4. Use additional preheating for cold starts.

A coolant heater is available for exceptionally cold environments. Consult an Onan distributor for details.

DUST AND DIRT

1. Keep the generator set and the cooling system clean.
2. Service the air cleaner as frequently as necessary.
3. Change the crankcase oil every 100 operating hours. Keep the governor linkage clean.

HIGH ALTITUDE

Maximum power is reduced approximately 4 percent for each 1000 feet (305 m) altitude.

OUT-OF-SERVICE PROTECTION

The lubricating qualities of diesel fuel should protect a diesel engine for at least 30 days when the unit is not in service. To protect a set that will be out of service for more than 30 days, proceed as follows:

1. Run the set under at least 50 percent load, until it is thoroughly warmed up.

2. Shut down the engine.
3. Disconnect the starting batteries and follow standard battery storage procedures.

⚠ CAUTION *Freezing temperatures may severely damage the starting batteries. When the batteries are in storage, be certain to maintain their liquid level. Use a trickle charger to maintain the correct specific gravity.*

4. Drain the oil from the crankcase while the engine is warm. Refill it with clean oil, and attach a tag listing the type of oil used.
5. If the unit will be exposed to freezing temperatures, drain the coolant from the engine, water pump, and cooling system components which are not protected by antifreeze. See the Draining Cooling System section.
6. Remove the flexible section of the exhaust line. (The exhaust should have a rain cap to prevent the entrance of moisture and dirt. If not, the exhaust can be plugged.)
7. Service the air cleaner.
8. Remove the glow plugs from the cylinders. Pour 1 ounce (30 ml) of rust inhibitor (or SAE #10 oil) into each cylinder. Crank the engine over several times. Reinstall the glow plugs.
9. Check the fuel filters for the presence of water, as shown in the Periodic Maintenance section.
10. Clean the throttle and governor linkage. Protect them by wrapping with a clean cloth.
11. Clean and wipe the entire unit. Coat parts susceptible to rust with a light coat of oil or grease.
12. Provide a suitable cover for the entire unit after it cools down.

DRAINING COOLING SYSTEM

⚠ CAUTION *Water freezing within engine components may damage or destroy them. Make certain to drain those components not protected from freezing (exhaust lines, water pump, intake and outlet lines, etc.).*

1. Open the vent valve or vent plugs.
2. To drain the water pump, loosen its cover and hose connections to release the water.

3. Drain the engine block by removing the 1/4 inch drain plug on the left front side of the engine.
4. Disconnect all hose clamps and hoses to aid draining.
5. Open the petcock on the bottom of the radiator and remove the fill cap. Replace the cap after the radiator has drained completely.
6. When all the water drains out, reconnect hoses, re-install drain plugs, and close all vent valves or plugs.

RETURNING THE SET TO OPERATION

1. Remove the protective cover from the unit. Wipe off dust and dirt.
2. Check that fuel lines and injectors are secure and properly torqued without air or fuel leaks.
3. Check the tag stating the oil type and weight. If it is not correct, drain oil from the engine, and refill with the correct oil. Be sure that it is up to "FULL" mark on dipstick.
4. Check coolant level and adjust if necessary. Service the cooling system with clean and fresh antifreeze. Prime the water pump and bleed air from the system.
5. Remove the material used to plug the exhaust outlet and reconnect the exhaust line. Check the complete exhaust system for tight connections. Note the condition of the muffler, exhaust line, etc., and repair as necessary.

⚠ WARNING *Exhaust gases contain carbon monoxide, which may cause severe personal injury or death. Before operating the generator set, make certain the exhaust line is connected correctly, is fit for operation, and does not leak.*

6. Check the entire generator set for water, fuel, or oil leaks. Correct as required.
7. Check the wiring system for worn wires, loose connections, etc. Repair as required.
8. Install the fully-charged batteries, and connect them to the generator set. Observe correct polarity. Connect the ground cable last.

⚠ WARNING *Explosive gases are emitted from batteries when they are being charged. Ignition of these gases can cause severe personal injury. Do not smoke or allow flame, sparks or arcing equipment in the vicinity while servicing batteries.*

9. Verify that no loads are connected to the generator.
10. Start the engine, and observe the oil pressure gauge and charge rate ammeter. After start, apply load to at least 50 percent of rated capacity.

After engine has started, excessive blue smoke will be exhausted until the rust inhibitor or oil has burned away.

11. Check the coolant level again. If acceptable, then the unit is ready for service, and a load may be applied.

HEAT EXCHANGER FILLING

Improper filling of the heat exchanger (Figure 5-3) can cause the engine to overheat. To prevent this possibility, follow these instructions when adding coolant to the heat exchanger.

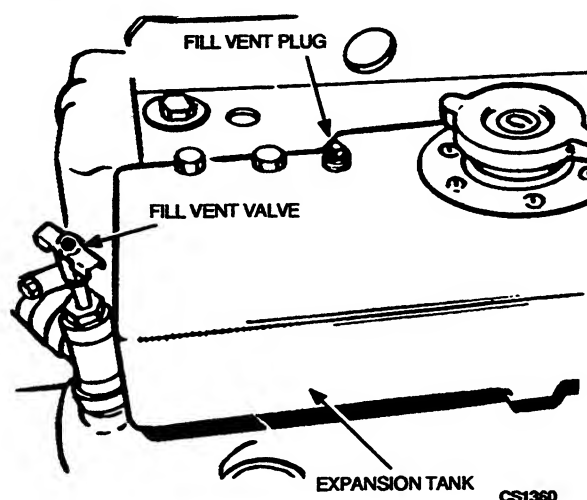


FIGURE 5-3. FILLING HEAT EXCHANGER

⚠WARNING *Contact with hot coolant or steam may severely burn the operator. For this reason, do not remove the pressure cap on the heat exchanger until the generator set has cooled. If this is impractical, the system may be opened while hot, only if certain precautions are taken. While wearing rubber Insulated gloves, safety goggles, and a rubber apron for protection, stand well back and turn face away from the pressure cap, and slowly open the cap, allowing the pressure to vent.*

1. Remove the fill cap.
2. Open the fill vent valve (turn counterclockwise).
3. Remove the vent plug.
4. Fill with coolant until vents begin to overflow.
5. Close fill vent valve (turn clockwise).

6. Replace the vent plug.
7. Replace the fill cap.
8. Operate the unit 10 minutes at full load; watch for leaks.
9. Shut down the unit.
10. Slowly open the pressure cap and check the water level.
11. Fill the system to top with coolant.

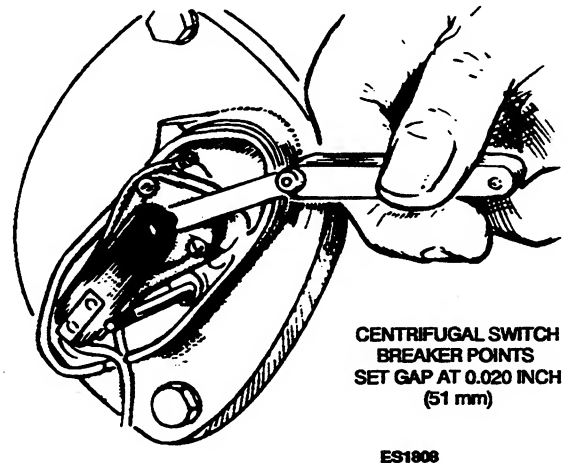
Section 6. Adjustments

⚠WARNING *Inadvertently starting the engine may result in damage to the generator set or serious personal injury. For this reason, disconnect the batteries, negative (-) cable first, before beginning any adjustment or maintenance work on the engine, generator, control panel, automatic transfer switch or associated wiring.*

CENTRIFUGAL SWITCH

The start-disconnect centrifugal switch (Figure 6-1) is located on the side of the engine, above the oil filter. The switch opens when the engine stops, and closes when engine speed reaches 900 rpm. If necessary, loosen the stationary contact and adjust the point gap to 0.020 inch (51 mm). Replace burned or faulty points.

⚠WARNING *High voltage, which can cause severe personal injury or death, is present at the breaker point gap. For this reason, disconnect the battery cable, negative [-] terminal first, before setting the breaker point gap.*



CENTRIFUGAL SWITCH
BREAKER POINTS
SET GAP AT 0.020 INCH
(51 mm)

ES1808

FIGURE 6-1. CENTRIFUGAL SWITCH ADJUSTMENT

GOVERNOR

The governor controls engine speed. On a 4 pole generator, engine speed equals frequency multiplied by 30. Thus 1800 rpm generates 60 hertz. Preferred engine speed does not vary more than 3 hertz from no-load to

full-load operation. Be sure that the throttle, linkage, and governor mechanism operate smoothly.

Speed Adjustment

To change the governor speed, change the spring tension by turning the governor spring nut, Figure 6-1. Turn the nut clockwise (more spring tension) to increase rpm, or counterclockwise to reduce governed speed. Use a stroboscope or a frequency meter to make this adjustment.

Sensitivity Adjustment

To adjust governor sensitivity (no-load to full-load speed droop), turn the sensitivity adjusting ratchet. On city water-cooled units, turning the ratchet counterclockwise provides more sensitivity (less speed drop when full load is applied), and turning it clockwise provides less sensitivity (more speed drop).

If the governor is too sensitive, a rapid hunting condition occurs (alternate increasing and decreasing speed). Adjust the governor for maximum sensitivity without hunting. After making the sensitivity adjustment, readjust the speed.

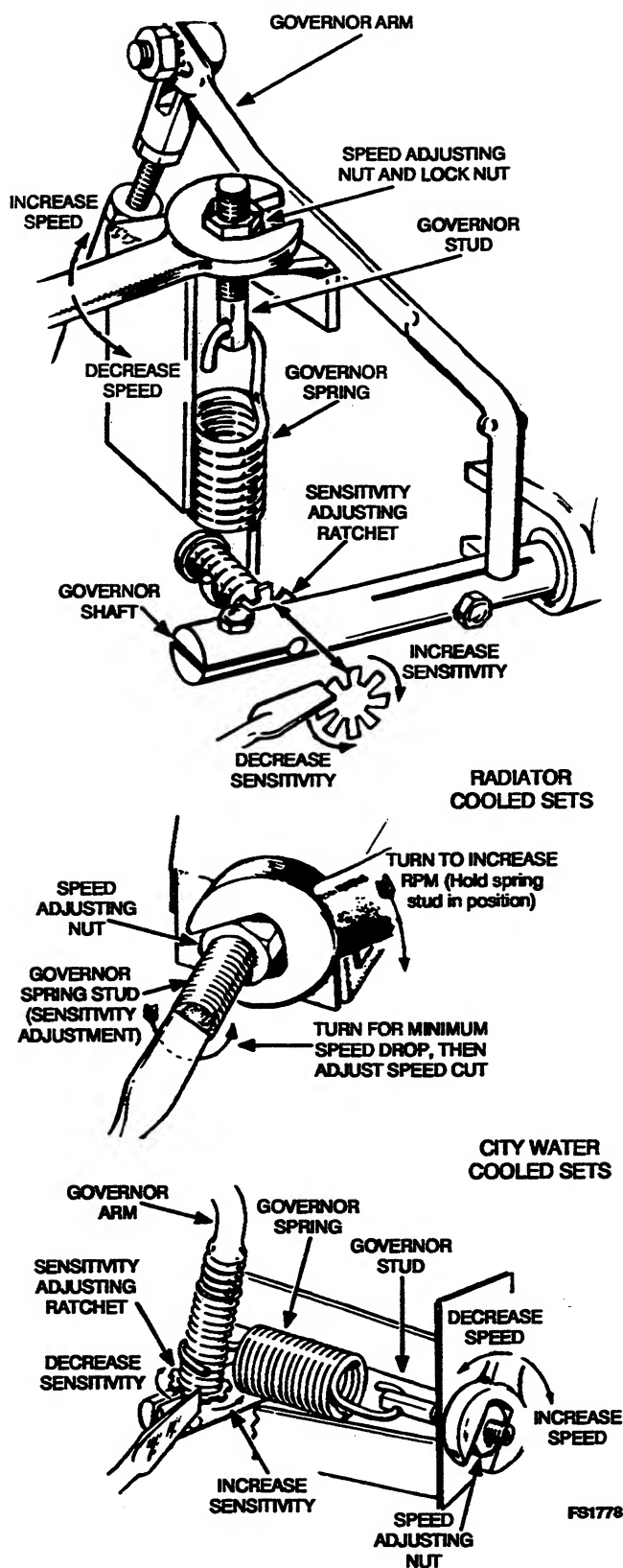


FIGURE 6-2. ADJUSTING GOVERNOR

CHARGE RATE ADJUSTMENT

The adjustable resistor slide tap in the charging circuit is set to produce a 2 ampere charging rate. This resistor is found in the generator air outlet. For applications requiring frequent starts, check the battery specific gravity periodically. If necessary, increase the charging rate slightly (move the slide tap up). Adjust this slide tap only when the engine is stopped.

⚠ WARNING Batteries present the hazard of explosion, which can result in severe personal injury. Because batteries produce explosive gas, do not smoke or allow any flame, sparks, or arc-producing devices in the battery area.

Avoid overcharging the battery. Make small increments of change until the proper rate has been determined to keep the battery charged.

VALVE CLEARANCE ADJUSTMENTS

Check the valve clearance when the engine is at room temperature, about 70°F (21°C).

⚠ CAUTION Incorrect valve clearance adjustment can lead to irrevocable damage to the generator set. Make certain that only qualified personnel perform this adjustment.

1. Turn the flywheel until the cylinder which is to have its valve adjusted is on its compression stroke. On engines without a hand crank, use a socket wrench on the flywheel hex head screw.

To determine if the cylinder is in its compression stroke, observe the push rods as the engine is rotated in a clockwise direction. The exhaust valve push rod will be in its lowest position, and the intake valve push rod will be moving downward. As the piston reaches top dead center, the flywheel timing mark should be aligned with the timing pointer, and the valve push rods should be stationary.

2. Turn the flywheel an additional 10 to 45 degrees clockwise (estimated). When the piston is in this position, it is in its power stroke, with both valves completely closed.
3. Adjust valve clearance with the locknut which secures the rocker arm to the cylinder head (see Figure 6-3). Loosen this locknut to increase clearance; tighten it to reduce clearance.

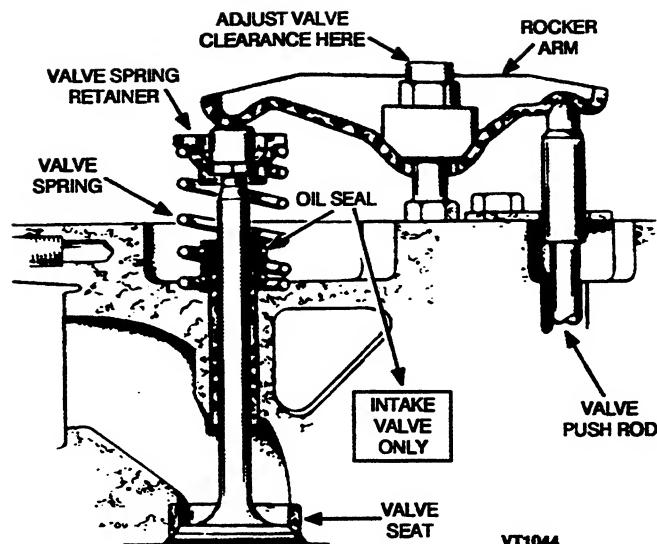


FIGURE 6-3. VALVE CLEARANCE ADJUSTMENTS

4. Using a feeler gauge, check the clearance between the rocker arm and the valve (see Figure 6-4). Increase or decrease the clearance until the proper gap is established. Valve clearances are listed in the Specifications section.

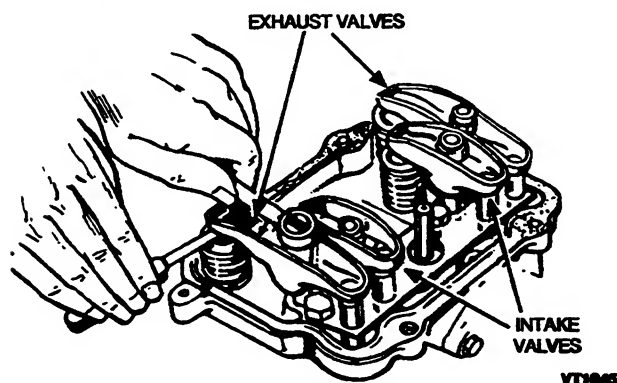


FIGURE 6-4. CHECK VALVE CLEARANCE

5. Always adjust valve clearances in the firing sequence (1-2-4-3). After positioning #1 cylinder, adjust the valve clearance according to steps 3 and 4.
6. To adjust the valve clearance of #2 cylinder, turn the flywheel clockwise exactly 180 degrees (one half revolution) from the position used when timing #1 cylinder.
7. Adjust #2 cylinder valve clearance according to steps 3 and 4.
8. To adjust the valve clearance for #4 cylinder, turn the flywheel clockwise 180 degrees (one half revolution). The flywheel should be between 10 and 45 degrees past the TC (top center) flywheel mark.
9. Adjust #4 cylinder valve clearance according to steps 3 and 4.

10. To adjust the valve clearance for #3 cylinder, turn the flywheel in a clockwise direction 180 degrees (one half revolution).
11. Adjust #3 cylinder valve clearance according to steps 3 and 4.

FAN BELT

Fan belt adjustment is vital to set operation.

⚠WARNING *Perform this adjustment only when the generator set is stopped. Remove the battery cables, negative (-) cable first, before performing this or any adjustment.*

To adjust the fan belt, loosen the nut on the belt tightener pulley shaft. Move the shaft left or right in the elongated slot in pulley mounting bracket until a deflection of 1/2 inch (12.70 mm) is obtained when about 15 pounds (67 N) of force is applied at a point midway between the fan pulley and belt tightener pulley. Be sure to tighten nut securely.

⚠WARNING *Incorrect fan belt adjustment can result in severe personal injury and/or equipment damage. Keep hands and fingers clear while performing tests on operating equipment.*

Section 7. General Maintenance

Follow a regular schedule of inspection and servicing, based on operating hours. Keep an accurate record of maintenance, service, and operating time. Use the running time meter (optional) to monitor operating hours. Follow the service schedule listed in the Periodic Maintenance Schedule on page 8-1.

⚠ WARNING Many maintenance procedures present hazards which can result in severe personal injury or death. Only qualified service personnel with knowledge of fuels, electricity, and machinery hazards should perform service procedures. Review the safety precautions on the inside cover page of this manual.

PERIODIC CHECKS

1. Check all fuel and oil lines for possible leakage.
2. Inspect exhaust lines and mufflers for possible leakage and cracks.
3. Periodically drain moisture from condensation traps.
4. Inspect the radiator for leaks and security. Be sure the cooling fins are clean.
5. Inspect electrical wires and connections for secureness and fray damage.

If the generator requires major repair or servicing, contact an authorized Onan service center.

⚠ WARNING Inadvertently starting the engine may result in damage to the generator set or serious personal injury. For this reason, disconnect the batteries, negative (-) cable first, before beginning any maintenance work on the engine, generator, control panel, automatic transfer switch or associated wiring.

BATTERIES

Check the condition of the starting batteries at least every two weeks. Make certain that connections are clean and tight. A light coating of non-conductive grease will retard corrosion at terminals. Add distilled water to keep the electrolyte at the proper level above the plates. Check the specific gravity; recharge if below 1.260 at 77°F (25°C).

⚠ WARNING Batteries present the hazard of explosion, which can result in severe personal injury. Disconnecting battery cables from the battery while the generator set is cranking or running causes arcing. For this reason, do not disconnect battery cables from the battery while the generator set is cranking or running. To avoid excessive arcing, always disconnect the negative (-) cable first, and connect it last.

⚠ CAUTION Discharged batteries are subject to severe damage if exposed to freezing temperatures. Store all batteries in a fully charged condition, and maintain their charge during storage.

FUEL FILTERS

Every 100 hours, open the drains on the bottom of the fuel filter assembly (Figure 7-1) and allow any water to escape. The drain plug on the fuel filter can tolerate only a limited amount of torque. Use two wrenches in combination for breaking the plug loose and for final tightening.

⚠ WARNING Fuel presents the hazard of fire or explosion which can cause severe personal injury or death. Do not permit any flame, spark, pilot light, cigarette, arc-producing equipment or other ignition source near the fuel system. Keep an ABC type fire extinguisher nearby.

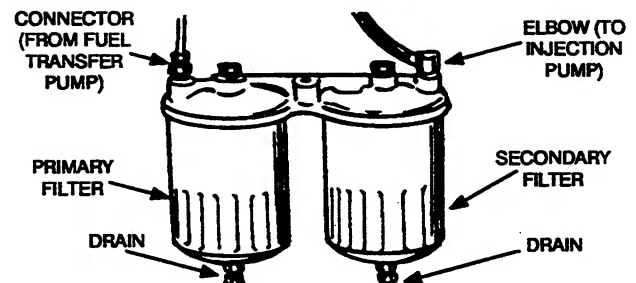


FIGURE 7-1. DUAL FUEL FILTERS

Every 600 hours, change the primary fuel filter by removing the washer and capscrew on top of the fuel filter body. Every 3000 hours, change the secondary fuel filter in the same manner as the primary fuel filter.

FS1113

⚠WARNING Fuel presents the hazard of fire or explosion that can cause severe personal injury or death. Do not work on the fuel system when the generator set is hot. Clean fuel spills and allow vapor to evacuate prior to starting the generator set.

GOVERNOR LINKAGE

Every 100 hours, carefully pull the neoprene governor ball joints apart and clean them. Do not lubricate these joints. See Figure 7-2.

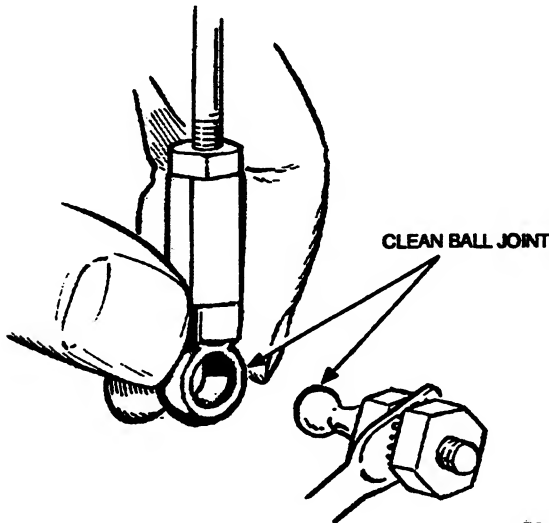


FIGURE 7-2. GOVERNOR BALL JOINT

⚠CAUTION Some solvents can damage the neoprene governor ball joints. Read the manufacturer's recommendations before using any lubricants or solvents near the ball joints.

⚠WARNING Fumes from this cleaner may present the hazard of fire or explosion, which can cause severe personal injury or death. Do not allow any spark, flame, pilot light, lit cigarette, arc-producing equipment or other ignition source near the generator set when performing this procedure. Keep a fire extinguisher rated ABC near the work area.

CRANKCASE BREATHER

To clean the crankcase breather tube, remove both rocker covers, as shown in Figure 7-3. The breather tube itself is installed with a sealant on the threads to prevent oil leakage into the intake manifold: it should NOT be removed. A small wire, nail or drill bit inserted through from the top can be used to clean out the breather hole. The breather hole seldom needs cleaning: a 500 hour interval coincides with the valve lash adjustments, because the rocker box covers must be removed at that time.

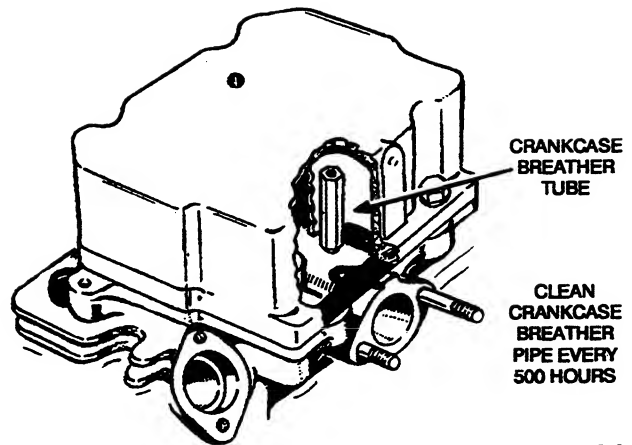


FIGURE 7-3. CLEANING BREATHER

COOLING SYSTEM MAINTENANCE

⚠CAUTION Hot oil or coolant can cause severe personal injury. Do not check the oil or coolant level while the generator set is running; wait until the generator set is cool before investigating.

The cooling system, including the block and radiator, should be cleaned and flushed at least once a year. This is especially true in cold weather, or when preparing the unit for extended storage (over 30 days).

The thermostat is calibrated to open at $150^{\circ}\text{F} \pm 2^{\circ}\text{F}$ (66°C). It should be checked for proper operation.

An appropriate anti-freeze solution should be used in colder climates.

For identification purposes, left and right sides of the set are viewed from the engine (radiator) end, the engine being the front and the generator the rear of the set.

The following drain plugs must be removed to allow complete flushing of the cooling system:

Radiator: Hose must be disconnected at the water pump to drain radiator.

Engine Block: One drain plug left front near water pump.

Water Pump: Loosen the pump cover.

More information on drain plug location and part numbers for the drain plugs throughout the set are contained in the parts catalog.

TESTING THERMOSTAT

If a sticking or faulty thermostat is suspected, test as follows:

1. Remove the thermostat from the cylinder head.
2. Heat a pan of water to approximately 150°F (66°C). Check the water temperature with a thermometer.

⚠ WARNING *Hot water can cause severe burns to the skin. Wear rubber gloves and use extreme caution when testing the thermostat with hot water.*

3. Suspend the thermostat in the hot water. It should start to open.
4. After the thermostat has opened completely, remove it from the hot water and allow it to cool in the surrounding air. It should close within a short time.
5. If the thermostat sticks or does not operate properly, replace it with a new one.

6. Always install a new gasket when replacing the thermostat.

FAN BELT

To adjust the fan belt, loosen the nut on the belt tightener pulley shaft. Move the shaft left or right in the elongated slot in the pulley mounting bracket until a deflection of 1/2 inch (13 mm) is obtained when about 15 pounds (20 N•m) of force is applied at a point midway between the water pump pulley and the belt tightener pulley. Be sure to tighten the nut securely.

AC GENERATOR

Periodic inspections that coincide with engine oil changes ensure good performance. When inspecting the rotating rectifier assembly (Figure 7-4), make sure that the diodes are free of dust, dirt and grease. Excessive foreign matter on these diodes and heat sinks will cause the diodes to overheat and fail. Blow out the assembly with filtered, low pressure air periodically.

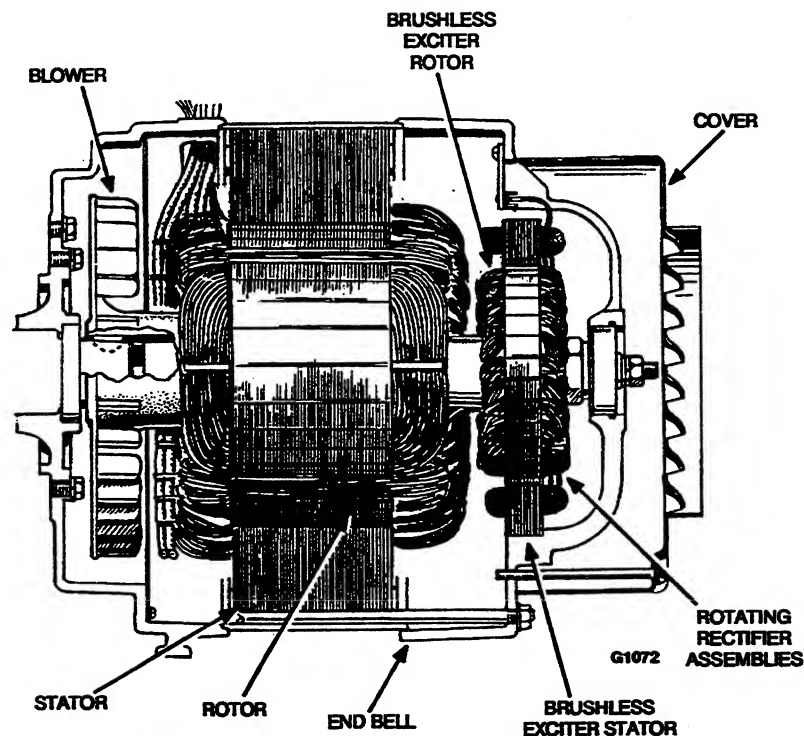
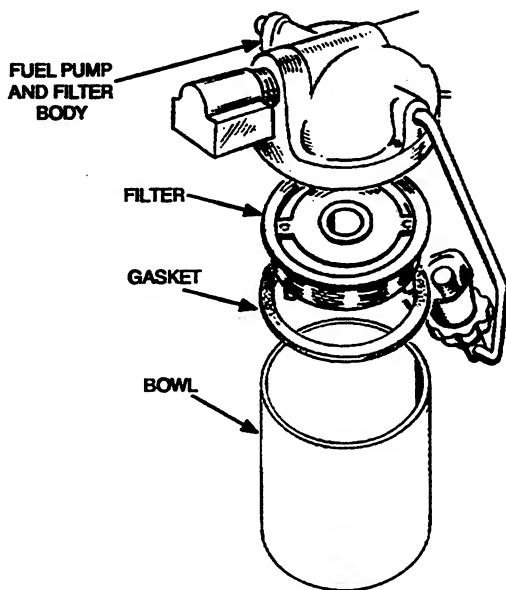


FIGURE 7-4. GENERATOR (CUTAWAY VIEW)

FUEL PUMP SEDIMENT BOWL

⚠WARNING *Fuel presents the hazard of fire or explosion which can cause severe personal injury or death. Do not permit any flame, spark, pilot light, cigarette, arc-producing equipment or other ignition source near the fuel system. Keep an ABC type fire extinguisher nearby.*

Every 100 hours, remove the sediment bowl from the fuel transfer pump and filter body (Figure 7-5). Clean out any water or particulate present in the bowl and filter. When re-installing the sediment bowl, make sure the filter and gasket are in place.

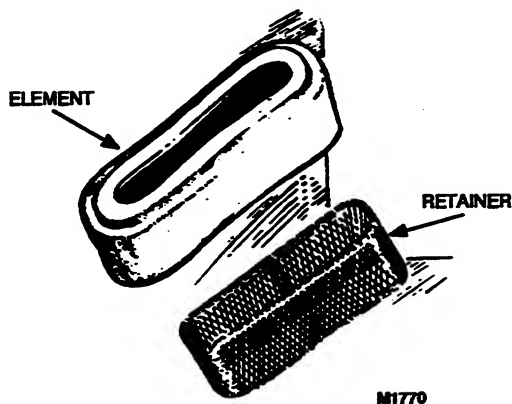


F8115

FIGURE 7-5. FUEL PUMP SEDIMENT BOWL

AIR CLEANERS

After every 50 hours of operation, remove and clean the filter element (Figure 7-6).



M1770

FIGURE 7-6. POLYURETHANE FOAM AIR CLEANER

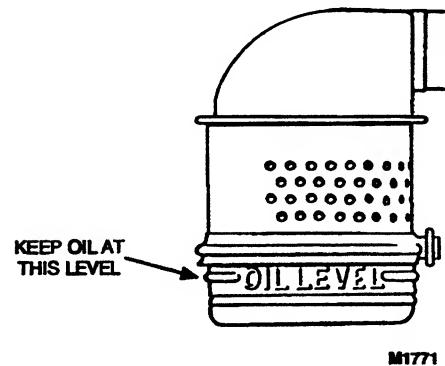
OIL FILTER CHANGE

Place the pan under the oil filter and remove the filter by turning it counterclockwise. Clean the filter mounting area. Oil filter gasket with clean oil. To install the new filter, turn the filter on clockwise until the gasket touches the mounting base, then tighten 1/2 turn.

⚠WARNING *Hot oil and a hot oil filter may cause severe burns to the skin. Wear goggles, apron and gloves when replacing the oil filter.*

OPTIONAL OIL BATH AIR CLEANER

1. Loosen the bottom clamp, remove the cleaner base and clean the part (Figure 7-7).
2. Refill the base to the oil level mark with fresh oil of the same weight as used in the engine.



M1771

FIGURE 7-7. OIL BATH AIR CLEANER

OIL CHANGE

⚠WARNING *Inadvertently starting the engine may result in damage to the generator set or serious personal injury. For this reason, disconnect the batteries, negative (-) cable first, before beginning any maintenance work on the engine, generator, control panel, automatic transfer switch or associated wiring.*

Stop the engine and drain the crankcase oil while the engine is still hot. Place a pan under the drain outlet and remove the oil drain plug or open the oil drain valve. After the oil is completely drained, replace the drain plug or close the drain valve. Refill with oil of the correct API designation and SAE viscosity grade for the temperature conditions (refer to Operation section).

⚠WARNING *Hot oil may cause severe burns. Wear goggles, apron and rubber gloves, and use extreme care when changing the oil.*

Section 8. Periodic Maintenance Schedule

Regularly scheduled maintenance means lower operating costs and longer service life for the generator set. The following schedule may be used as a guide. However, actual operating conditions should determine the maintenance schedule. In exceptionally dusty or dirty conditions, certain service periods may have to be re-

duced. Check the condition of the crankcase oil, filters, etc., frequently, until the proper service time periods are established.

If any abnormalities in operation, unusual noises from engine or accessories, loss of power, overheating, etc. occur, contact the nearest authorized Onan dealer.

HOURS OF OPERATION	MAINTENANCE TASK
8	<ul style="list-style-type: none">• Inspect exhaust system• Inspect generator set• Check fuel supply; see Note 1• Check oil level
50 (more often in dusty conditions)	<ul style="list-style-type: none">• See Note 3.• Check air cleaner
100	<ul style="list-style-type: none">• Clean governor linkage• Change crankcase oil (or annually)• Clean sediment bowl and filter on fuel transfer pump. See Note 1.• Replace oil filter• Check battery condition
500	<ul style="list-style-type: none">• Check start-disconnect circuit• Check valve clearances
600	<ul style="list-style-type: none">• Change primary fuel filter
2000	<ul style="list-style-type: none">• Grind valves (if required)• Clean holes in rocker box oil line• Check nozzle spray pattern; see Note 2• Clean generator
3000	<ul style="list-style-type: none">• Change secondary fuel filter
5000	<ul style="list-style-type: none">• General overhaul (if required) See Note 3.

1. Water or foreign material in fuel can ruin the injection system. If daily inspection shows water or excessive dirt in sediment bowl, fuel handling and storing facilities should be checked and situation corrected. Primary and secondary fuel filters can be replaced following correction of fuel contamination problem.
2. This service must be conducted by trained diesel injection equipment personnel with suitable test facilities. Omit this service until these conditions can be met.
3. Tighten head bolts and adjust valve clearance after first 50 hours on new and overhauled engines, and then adjust valve clearance each 500 hours thereafter.

⚠WARNING Exhaust gas presents the hazard of severe personal injury or death. Inspect the exhaust system audibly and visually each day, or each time the generator is started (whichever is sooner). With the generator set running, momentarily open the access cover to inspect the muffler. Shut down the generator set and have any leaks repaired immediately.

⚠WARNING Failure to disconnect the generator set battery could result in damage to equipment or serious personal injury in the event of inadvertent starting. Before beginning any maintenance work on the engine, generator, control panel, automatic transfer switch or associated wiring, disconnect the battery, negative (-) cable first.

⚠WARNING Many troubleshooting and maintenance procedures present hazards which can result in severe personal injury or death. Only qualified service personnel with knowledge of fuels, electricity, and machinery hazards should perform service procedures. Review safety precautions on inside cover page before attempting these maintenance procedures.



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